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FACULTY OF ECONOMICS

DEPARTMENT OF FINANCE

Application of the CorporateMetrics Methodology in the ŠKODA AUTO, a.s. Company

Aplikace metodologie CorporateMetrics ve společnosti ŠKODA AUTO, a.s. Company

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1. Introduction
2. Description of the CorporateMetrics Methodology
3. Characterization of the ŠKODA AUTO, a.s. Company
4. Application of the CorporateMetrics Methodology
5. Conclusion

Bibliography
List of Abbreviations
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References:

BODMER, Edward. *Corporate and Project Finance Modeling.* 1st ed. New York: Wiley, 2014. ISBN 978-1-118-85436-5.
LEE, Alvin Y. *CorporateMetrics Technical Document [online].* New York: RiskMetrics Group, J. P. Morgan, 1999. [2017-08-04]. Available at: https://www.msci.com/documents/10199/8af520af-3e63-44b2-8aab-fd55a989e312
ZMEŠKAL, Z., D. DLUHOŠOVÁ and T. TICHÝ. *Financial Models.* 1st ed. Ostrava: VSB-Technical University of Ostrava, 2004. ISBN 80-24807548.

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"I hereby declare that I have elaborated the entire thesis including annexes myself."

Ostrava dated 15th April, 2018

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Student name and surname

Content

1. Introduction

The main goal of this thesis is that to estimate the net operating income probability distribution of ŠKODA AUTO in 2018 by applying the CorporateMetrics methodology.

This diploma thesis has totally 5 chapter.

In the chapter 2, it introduces the basic principle of CorporateMetrics methodology. Also, it describes the methods which will be used in the calculation. What added, it explains how to use the methods and the simplification.

In the chapter 3, it includes 3 parts. It will introduce the origin and development of our company in first part. In next part, it analysis the financial condition our company has. At last, it is about the SWOT analysis aimed to know furtherly about company's products.

Then, in the chapter 4, it starts to predict parameters with the methods and processes which are mentioned in chapter 2. It includes prediction of exchange rate, average price per one car, total quantity of cars being sold and so on. After prediction of all the parameters, it will come with the estimation of company's net operating income.

The chapter 5 is conclusion. While finishing all the prediction, estimation and analysis, there comes with the conclusion of this thesis.

2. Description of the CorporateMetrics Methodology

This chapter is about the description of our methodologies and it includes 5 sub-chapters, which are principle of CorporateMetrics, methods of prediction, estimation of net operating incomes, frequency analysis and added introduction.

2.1 Basic principle of CorporateMetrics

This part is aimed to introduce the basic principle of CorporateMetrics.

2.1.1 Framework of CorporateMetrics

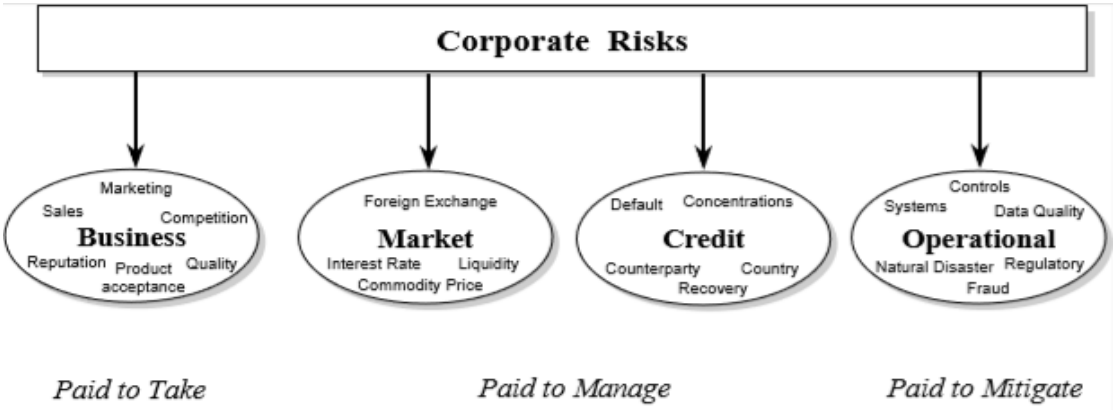
CorporateMetrics is a conceptual framework, which use to measure market risk aimed to the companies.

The framework can be separated into 5 parts, they are:[1]

a): Definitions for risk which faces to companies

Before we want to measure a risk, we first need to classify the risk. This part is main focused to give definition to different kind of risks and find which type of risk can be measure with CorporateMetrics methodology.

Chart 2.1 Type of risk faced to company



(Source: LEE, Alvin Y. CorporateMetrics Technical Document [online]. New York: RiskMetrics Group, J. P. Morgan, 1999. [2017-08-04] p.5)

[1] KIM, J., MALZ, A.M., MINA, J.. LongRun Technical Document [online]. 1st. Ed. New York: RiskMetrics Group, 1999 [cit. 2009-01-31]. Available from WWW: <http://www.riskmetrics.com>

As chart 2.1 clearly showed, each company mainly faced these four types of risk. Among them, CorporateMetrics methodology is focused on solution of market risk by the reason of the special characteristics of market risk. The target value which will cause market risk to company has a characteristic that it is random evolution in time, like exchange rate. By this reason, company will be referred to uncertainly future financial results especially on the incomes and the expensed in the international trade.

b): Measurement methodologies for market risk

After give definition to corporate risk, we know CorporateMetrics is used to measure the market risk of companies. Then there follow the methodologies used to measure the market risk. CorporateMetrics methodologies can measure risk by financial results: Earnings-at-Risk (EaR), Earnings-per-share- atRisk (EPSaR) and Cash-Flow-at-Risk (CFaR).

c): Methodology to get related data used to predict market price in long-run

Within the methodology of market risk measurement, we need to know how to get the data which will be used in the measurement. The risk measurement we want to get by the CorporateMetrics methodologies is the financial results under market risk. So, we still need to use methodologies to estimate related data firstly and then we can estimate company's financial results. This part in the framework gives the methodology to get and calculate the related data.

d): Website which contains history data we need

All the prediction and calculation are based on the companies' history data. As we know the what data we need by methodology in previews parts, we will find them on the relative websites.

e): With the methodology and data applying to calculate the risk

After we know the target risk which need to measure, the measurement methodology and the history data we need, we can start to apply into calculation and get the conclusion.

2.1.2 Procedure of applying CorporateMetrics

After introducing the framework of CorporateMetrics, we can apply it steps by steps.

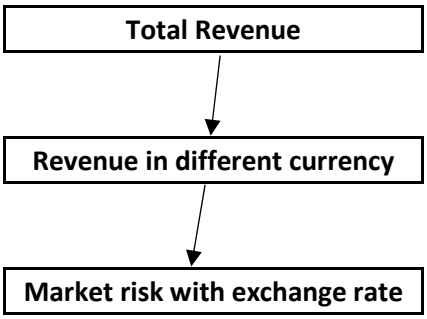
a): Metric specification

Before we want to measure market risk of a company. We need to confirm a risk measurement for measurement. In our thesis, the risk measurement we choose is Earnings-at-Risk (EaR). The results will reflect how much earning company will get under different level.

b): Mapping risks of the company

As we know, the financial result has several components. Mapping risks of company means to find which component exists market risk.

Chart 2.2 Simple example for mapping risks of company



(Source: Own)

From chart 2.2, we can clearly see the basic function of mapping risks of company. We can know that the main indicator will cause market risk in terms of revenue is the market exchange rate.

c): Scenario generation

As we know the market indicator like exchange rate is random evolution, so we can't just estimate it only for 1 scenario. We need to generate large numbers of scenario, which means we will estimate same numbers of probability results and we also will see different possible toward of the indicator in the future at the results.

d): Assessment

In the previews part, we know what components we need and in this part we start to estimate it. In totally, there are two parts. First part is about estimation of market risk indicator, which in our thesis is exchange rate. The other part is the elements related to company's financial results.

e): Risk calculation

By the assessment of company's financial results with market indicator, we will have large numbers of scenarios of the financial results. Then we can measure company's market risk by methodology of risk measurement which provided by CorporateMetrics.

2.2 Method of prediction

The aim of this part is to introduce the methods of the prediction. In totally, there are three methods used to the predict the data we need. Three methods are Geometric Brownian process model, average growth rate and the arithmetic mean. We use these methods to predict different data we need via different method.

2.2.1 Geometric Brownian process

Geometric Brownian process is a method belonged to financial model. With this model, we can apply to the simulation the random evolution of market price, like market exchange rate.

The value of market exchange rate is changed like random evolution in time. So, we adopt Geometric Brownian process to estimate future market exchange rate.

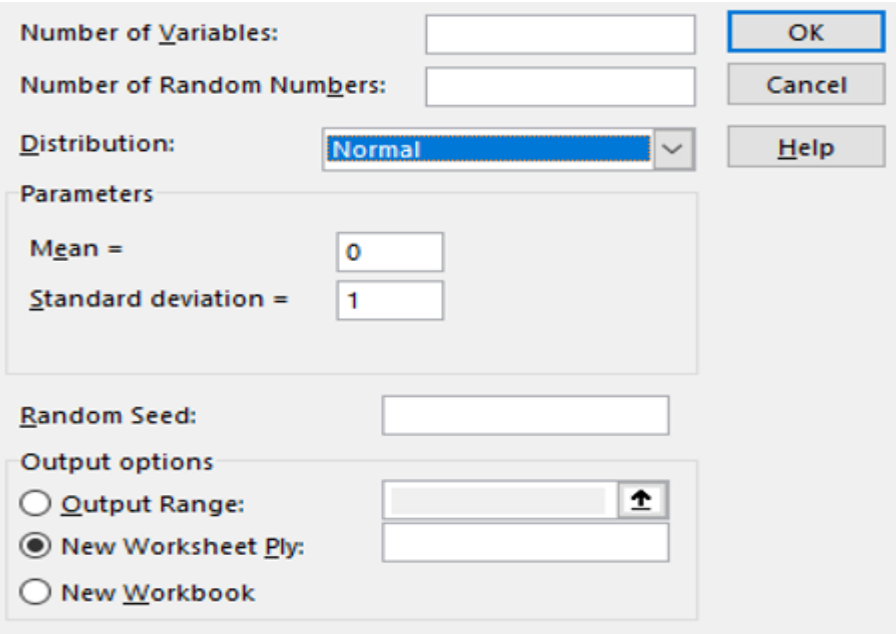
The model is based on several scenarios of random numbers and its special functions.

a) Random number generation.

In order to generate random numbers we can apply a whole range of procedures with various degree of complexity and accuracy. In Excel we can use the module which is called Random Number Generation by which it is possible to generate random numbers for a prespecified probability distribution. We should note, however, that this generator does not comply with all professional quality requirements. Notwithstanding, the compute results can be considered as relatively good and reliable.[2]

[2] Zmeškal, Z., Dluhošová, D. and Tichý, T. (2004). Financial models. Ostrava: VSB - Technical University, Faculty of Economics, p.108

Chart 2.3 Random Number Generation



(Source: Own)

For the probability distribution, the model acquires to use is the standard normal distribution. We will explain it in the section b.

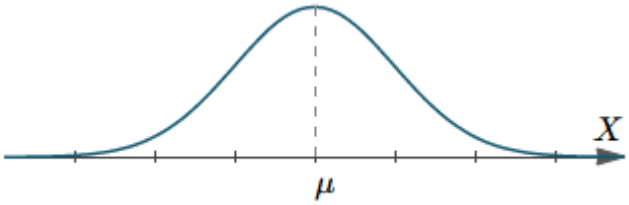
b) Probability of distribution

We generate 1000 scenarios of random numbers to stimulate random evolution of the future prices of exchange rate. Further, the price evolution must have a probability distribution. This part will introduce the probability distribution which is used in our methods of Geometric Brownian process

Normal probability distribution

The normal probability distribution is known as the most common probability distribution.

Chart 2.4 Example of normal probability distribution



(Source: https://www.intmath.com/counting-probability/14-normal-probability-distribution.php)

Where followed the function:

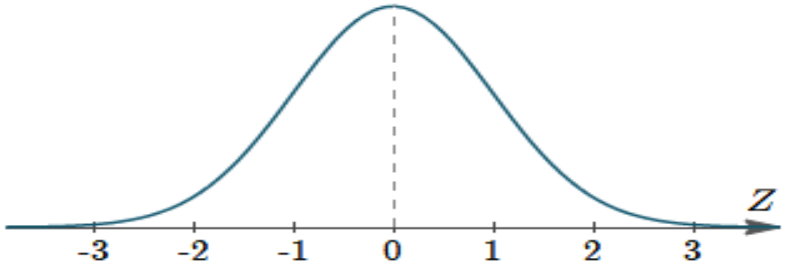
$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-(x-\mu)^2/2\cdot\sigma^2} \qquad (2.1)$$

The normal distribution states $N\ (\mu, \sigma^2)$, where μ is the mean value of the random variables and σ^2 is the variance of the random variables.

Standard normal probability distribution

In normal probability distribution, there exist a special condition which is the standard normal distribution.

Chart 2.5 Example of standard normal distribution



(Source: https://www.intmath.com/counting-probability/14-normal-probability-distribution.php)

The graph is like the example we give on chart 2.5. Then followed the function:

$$\varphi(x) = \frac{1}{\sqrt{2\pi}} e^{-(x)^2/2} \qquad (2.2)$$

The function is similar to the function 2.1 and what different is that the standard normal distribution states $\tilde{\mathbf{z}}(0,1)$, which means the mean value(μ) of the random numbers is equals to 0 and variance (σ^2) of random variable is equal to 1.

c) Logarithmic price change

The logarithmic price change is one methods used to estimate continues yields of prices and the advantage of logarithmic price change is that we can remove the influence of the price level which based on the assumption that the total gross price level is same with (1+Reture of price (R_t)) The function is as followed:

$$R_t = \mathrm{Ln}(1 + R_t) = \mathrm{Ln}\left(\frac{P_t}{P_{t-1}}\right) = P_t - P_{t-1} \tag{2.3}$$

d) Normal distribution with logarithmic price change

In this part, we will introduce how to apply the logarithmic price change which is same with mean of the random variables in normal distribution.

We can express it as $LN\ (\mu, \sigma^2)$, where μ is the mean of the logarithmic price change of the random variables and $\sigma^2$is the variance of the logarithmic price change of the random variables. It is like the function followed:

$$\mathrm{f(x)} = \frac{1}{\sigma\cdot\sqrt{2\pi}} \cdot \frac{1}{x} e^{-\frac{1}{2}(Lnx-\mu)^2/\sigma^2} \tag{2.4}$$

Then is function about the mean value ($E(P_t)$) and variance (${\sigma_t}^2(\ P_t)$) of the random variables.

$$E(P_t) = e^{(\mu+\frac{{\sigma_t}^2}{2})} \tag{2.5}$$

$${\sigma_t}^2(\ P_t) = e^{2\cdot\mu} \cdot e^{2\cdot{\sigma_t}^2} \cdot e^{{\sigma_t}^2} \tag{2.6}$$

e) Application of method

The Geometric Brownian process used to stimulate the random evolution of market price.

The calculation for estimation is according to the function:

$$S_t = S_{t-1} \cdot e^{(\alpha\cdot\Delta t+\sigma\cdot\tilde{z}\cdot\sqrt{\Delta t})} \tag{2.7}$$

Where S_t means the market price in time t (t=1 means the value estimation at first time period); α is the trend coefficient of the history data; $\tilde{z}$ is the random variable we generate correspond to estimated value in time t; Δt is the time interval of history data correspond to time interval of estimated data.

Furtherly,

$$\alpha = \mu - \frac{\sigma^2}{2} \tag{2.8}$$

$$\mu = \frac{\sum_{T=1}^{T} Ln\frac{S_T}{S_{T-1}}}{T} \tag{2.9}$$

Where μ is the average logarithmic price change and σ is the standard deviation of logarithmic price change.

In Excel, the object estimation function is:

$$S_t = S_{t-1} \cdot exp^{(\alpha \cdot \Delta t + \sigma \cdot \tilde{z} \cdot \sqrt{\Delta t})} \tag{2.10}$$[3]

We apply the function in Excel to each scenario of random numbers with standard normal probability distribution. In our thesis, we will generate 1000 scenarios for each exchange rate. Finally, there are 1000 probable scenarios of the estimated random evolution for each exchange rate.

2.2.2 Average growth rate

The average growth rate is the percentage average increase in terms of the target value or number over same time interval. In our thesis, we use average growth rate to estimate the total quantity of the car production for a year, average cost of the production for a car and average car price.

For apply it into estimation we need to use the function followed,

$$S_t = S_{t-1} \cdot (1 + k) \tag{2.11}$$

[3] Zmeškal, Z., Dluhošová, D. and Tichý, T. (2004). Financial models. Ostrava: VSB - Technical University, Faculty of Economics, p.109

Where S_t is the future value we estimate and coefficient k is the average growth rate.

For calculate coefficient k, we will use the function followed,

$$k = \frac{\sum_{T=2}^{T} \frac{S_T - S_{T-1}}{S_{T-1}}}{T} \tag{2.12}$$

Where S_T is the value in the history time period, especially T is ordinal number of the history time interval.

Then, we demonstrate the procedure by table followed.

Table 2.1 Procedure of applying average growth rate

X1	
X2	G1
X3	G2
X4	G3
	K
X5=X4*K	
X6=X5*K	

Like the table 2.1 indicated, we have past four values(X1, X2, X3, X4) with same time interval and we want to estimate the value for the fifth and sixth(X5 and X6). We first calculate the growth rate for three intervals(G1, G2, G3) then we can get coefficient k which is the average value of growth rate we have. At last, just use latest value time coefficient k, we can get the estimated value.

2.2.3 The arithmetic mean

The arithmetic mean is the most basic and easier way used into the estimation. But, the object value which selected to use this method has its special characteristics. The first characteristic is that the value is disorder for each value or the volatility is very big. The second characteristic is that the change of the value for each time interval is very little.

In our thesis, we use arithmetic mean to estimate quantity of un/over sale cars and fix cost of company. The quantity of un/over sale cars is like we mentioned in the first characteristic, the value for a year is totally unregular and the fix cost fits the second characteristic, the change for each year is very little, so we use this method to estimate.

The calculation function is as followed:

$$S = \frac{\sum S_T}{T} \tag{2.13}$$

Where S is the value we predict, S_T is the history data and the T is the order of the time.

2.3 Estimation of net operating income

In this part, we will introduce how to estimate company's net operating income after we apply method estimating the data we need.

Table 2.2 Simplify company's income statement

Total operating Revenue
Variable operating cost
Fix operating cost
Total operating cost
Net operating income

The Table 2.2 is the simplify company's income statement. The relationship is as followed.

$$\text{Net operating income} = \text{Total operating revenue} - \text{Total operating cost} \tag{2.14}$$

From the function, if we want to estimate earning after tax, we need to estimate revenue and total cost.

For operating revenue, we have:

$$R_t = \overline{P_t} \cdot Q_t^S \tag{2.15}$$

Where R_t is the operating revenue at time t, $\overline{P_t}$ is the average price at t and Q_t^S is the quantity of car being sold in the time t.

By the reason that Skoda is an international company, the revenue will receive from different currency, we need to estimate revenue separate from different country and transform to the currency in Czech which is CZK.

$$R_{CZK} = R_{other\ country} \cdot E\text{xchange rate} \tag{2.16}$$

Then is about estimation of total operating cost, as we mentioned in table 2.2, total operating cost includes variable operating cost and fix operating cost.

For variable operating cost, we have:

$$VC_t = \overline{C_t} \cdot Q_t^P \tag{2.17}$$

Where VC_t is the variable operating cost during time t, $\overline{C_t}$ is the average operating cost for 1 car during time t and Q_t^P is the quantity of car produced in time t.

Then we focused on estimation of fix operating cost, it is use the method we mentioned in 2.2.3, the function is as followed:

$$FC_t = \frac{\sum FC_T}{T} \tag{2.18}$$

Where FC_t is the estimated fix operating cost and FC_T is the fix operating cost in the history.

2.4 Frequency analysis

In our thesis, we predict 1000 scenarios for each exchange rate for stimulate the random evolution of the price. It is very hard to observe 1000 results directly and for easily to analysis the distribution of results, we apply the method of frequency analysis. The frequency analysis has 3 steps in totally.

Firstly, we should set the numbers of the interval, which is 19 in our thesis. Then we need to calculate the value of equidistant interval. It is calculated by the function followed:

$$\mathrm{E} = \frac{Max - Min}{N-1} \tag{2.19}$$

Where E is the equidistant interval, Max and Min are means the biggest and the lowest value in our total sample and N is means the numbers of the time interval we set. Then, we can calculate each value of interval by the function followed.

$$I_n = I_{n-1} + E \tag{2.20}$$

Each value of interval is equal to the value equidistant interval plus the last value of interval.

Table 2.3 Example of value of interval in frequency analysis

Interval numbers	
I1	Min
I2	I1+E
I3	I2+E
I4	I3+E
I5	Max

Like we have shown on the table 2.3, we can get the value of each interval by function 2.20.

Then, we can apply the function (Frequency) in excel to calculate the frequency of our prediction value being distributed in the ranges.

2.5 Added introduction of calculation

In our thesis, there are several assumptions and simplifications by the reason that we can't find all the information we need.

2.5.1 Simplification on car price

We make a simplification on calculation of car price. We use function followed to estimate car price in the history.

$$\bar{P} = \frac{R}{Q} \tag{2.21}$$

We assume each car is sold on the same price and we calculate the price per car by function 2.21, which is operating revenues divided total quantity of car being produced. The reason for

this simplification is that Skoda has many brands of cars and each brand of car has different price.

Our company sells car to several foreign countries. Then we will face the problem that how much the car will be sold in different currency.

So, we assume, the car price in other countries is based on the domestic car price and calculate as followed.

$$P_{Foreign} = \bar{P} \cdot E_{Last\ year} \tag{2.22}$$

Where, $E_{Last\ year}$ is the average foreign exchange rate in last year.

2.5.2 Assumption on production

Then is about assumption on the production. We assume that all cars are produced in domestic country, which is Czech. The benefit of the assumption is that we can ignore the mark risk from the production because the spend of cost is all in CZK. We also assume that the operating cost for 1 car is same and we can calculate it by function followed:

$$\text{Operating cost for 1 car} = \frac{Cost\ of\ production}{Total\ quantity\ of\ car\ being\ produced} \tag{2.23}$$

2.5.3 Simplification on translation revenues

By the reason that we don't know the frequency and when our company will transfer the operating revenues from foreign currency to domestic currency, we make the simplification that company will do the translation of the operating revenues at the end day of each weeks. We also assume that Skoda sells same quantity of cars for each week in a specific country. By these assumption, we can calculate weekly operating revenues from foreign country by the function followed:

$$\mathrm{R}_{Foreign} = P_{Foreign} \cdot Q_{Foreign} \tag{2.24}$$

3. Characterization of the ŠKODA AUTO, a.s. Company

In chapter 3, we will introduce the characterization of our company. We will introduce it through 3 parts, which are history, financial condition and SWOT analysis.

3.1 Overview of the ŠKODA AUTO

Our company's full name is ŠKODA AUTO, a.s. , we will introduce the basic history and development of our company in this chapter.

Chart 3.1 Brands of ŠKODA AUTO

(Source: http://www.skoda-auto.com/company/about)

3.1.1 Origin of the ŠKODA AUTO

For the origins of Škoda Auto, we should go back to the early 1890s when, like many long-established car manufacturers, a company started manufacturing bicycles Škoda (then Laurin & Klement) factories were founded in 1896 as a velocipede manufacturer.

Chart 3.2 Bicycles Škoda

Source(http://www.skoda-auto.com/company/about)

[4] Source: http://www.skoda-auto.com/company/about

3.1.2 Development of ŠKODA AUTO

In 2012, Škoda introduced an emission-free fleet of Octavia Green E Line e-cars on Czech roads to be used by external partners

In 2013, the Czech car maker launched the third-generation Octavia Combi and Octavia RS (both liftback and estate) as well as facelifted Superb and Superb Combi. They were accompanied by brand new members of the Rapid family as the Rapid Spaceback, the first Škoda hatchback car in the compact segment, and the Chinese version of the Rapid. Chinese customers were also given a Yeti with an extended wheelbase.

In 2015, Volkswagen admitted that it had installed pollution-cheating software in many of its cars to fool regulators that its cars met emissions standards when in fact they polluted at much higher-levels than government standards. 1.2 million Škoda cars worldwide were fitted with this emissions-cheating device. Škoda stated that Volkswagen would recall and cover refitting costs for all of the cars affected by the Volkswagen emissions testing scandal.

In 2015, Škoda was voted the most dependable car brand in the UK. A corporate strategy was launched in 2015 to produce an all-electric car by 2020 or 2021 with a range of over 500 kilometres, 15-minute charging time, and a cost below comparative combustion-engine vehicles.

In 2016, Škoda Auto started to manufacture a large, seven-seat SUV Škoda Kodiaq in 2016, intended to be a true off-roader, it was introduced at the Paris Motor Show in October 2016 and sales began at early 2017.

With the high speed of development, now Škoda Auto sell the cars with its brands around the world. [5]

3.2 Financial condition of company

We focus to analysis our company's financial condition in this part through our company's balance statement and income statement.

[5] Source: http://www.skoda-auto.com/company/about

3.2.1 Assets in balance sheet

We find value of company's current assets and nom-current assets from balance sheet and the results is as followed.

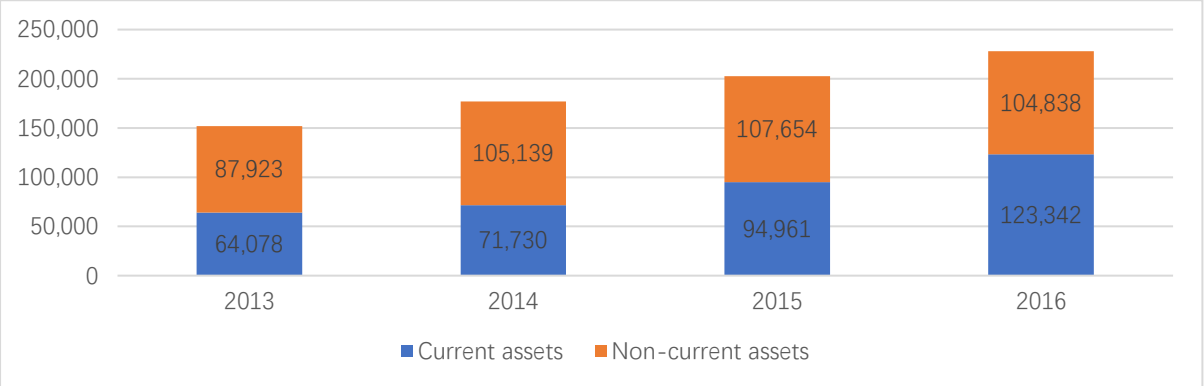
Table 3.1 Assets of Skoda from 2013 to 2016

	2013	2014	2015	2016
Current assets	**64,078**	**71,730**	**94,961**	**123,342**
Non-current assets	**87,923**	**105,139**	**107,654**	**104,838**
Total assets	**152,001**	**176,869**	**202,615**	**228,180**

(Unit of currency is in million CZK)

To compare current assets and non-current assets clearly, we make it to the chart.

Chart 3.3 Assets of Skoda from 2013 to 2016



(Unit of currency is in million CZK)

From chart 3.2, we can clearly see that from 2013 to 2015, the value of company's non-current assets is larger than current assets and in 2016, the current assets in bigger than the non-current assets.

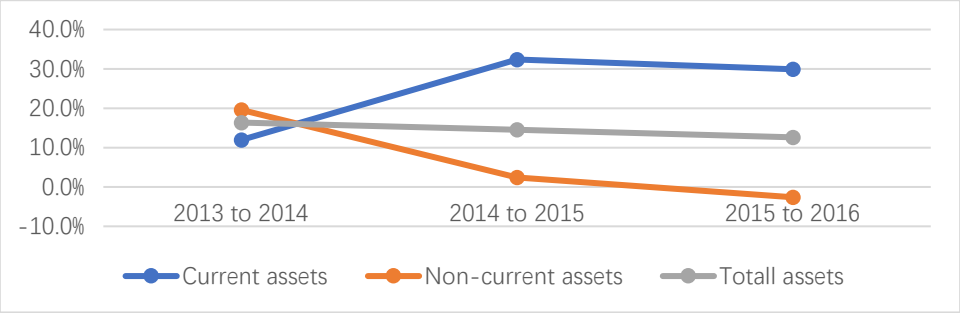
Table 3.2 Annual growth rate of assets from 2013 to 2016

	2013 to 2014	2014 to 2015	2015 to 2016
Current assets	11.9%	32.4%	29.9%
Non-current assets	19.6%	2.4%	-2.6%
Total assets	16.4%	14.6%	12.6%

From table 3.2, we can know the highest annual growth rate for current assets is 32.4% from 2014 to 2015. For non-current assets, the highest annual growth rate is 19.6% from 2013 to 2014 and for total assets is 16.4% from 2013 to 2014.

Then we can see the trends from chart followed:

Chart 3.4 Annual growth rate of assets from 2013 to 2016



From chart 3.3, we can clearly see 3 different trends of current assets, non-fix assets and total assets. For current assets it has big increased on trend from first time step to second and then trend is decreased from second time step to the end. For non-current assets, trends is decreasing from start to end and the trends of total assets is also decreasing from start to end.

3.2.2 Operating income in income statement

In this part, we aim to know the financial results of our company in term of operating income. We find the history data in income statement from 2013 to 2016.

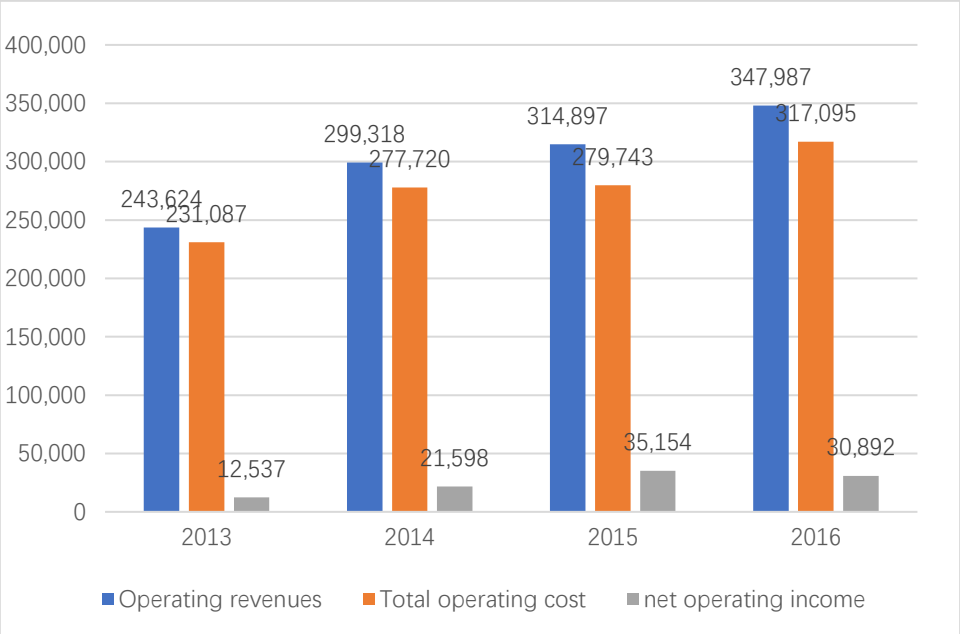
Table 3.3 Net operating income of Skoda from 2013 to 2016

Operating revenues	**243,624**	**299,318**	**314,897**	**347,987**
Total operating cost	**231,087**	**277,720**	**279,743**	**317,095**
net operating income	**12,537**	**21,598**	**35,154**	**30,892**

(Unit of currency is in million CZK)

Then we can clearly see the results into chart.

Chart 3.5 Net operating income of Skoda from 2013 to 2016



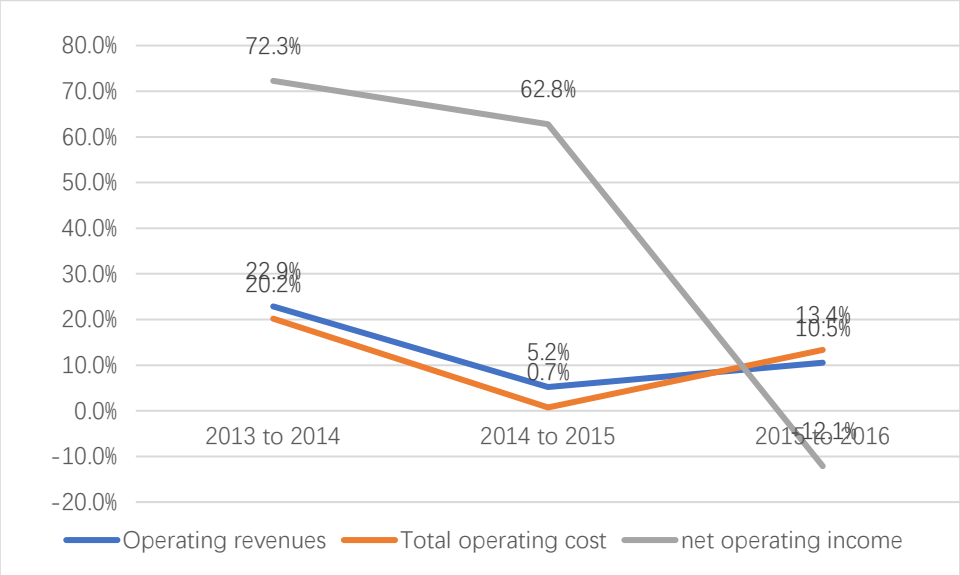
From chart 3.5, the operating revenues and the total operating cost are increased year by year, but net operating income is increased from 2013 to 2015 year by year but it is decreased in 2016 compared to 2015.

Table 3.4 Annual growth rate of net operating income of Skoda from 2013 to 2016

	2013 to 2014	**2014 to 2015**	**2015 to 2016**
Operating revenues	22.9%	5.2%	10.5%
Total operating cost	20.2%	0.7%	13.4%
net operating income	72.3%	62.8%	-12.1%

From table 3.4, we can know that the highest annual growth rate for operating revenues is in 2013 to 2014 which is 22.9%. For total cost, the highest annual growth rate is in 2013 to 2014 which is 20.2% and it is same with the net operating income which is 72.3% from 2013 to 2014.

Chart 3.6 Annual growth rate of net operating income of Skoda from 2013 to 2016



From chart 3.6, we can know there has a same trend for operating revenues and total operating cost. For trends of the net operating income is opposite with the trend of operating revenues and total operating cost.

3.3 SWOT analysis of Škoda

SWOT analysis is a method focused on four parts of company, which are strengths, weaknesses, opportunities and treats for company.

There are several advantages for company to do the SWOT analysis. Firstly, company will know where they did good job and they will keep these strengths even do better. Secondly, after knowing the weaknesses company has, company will think the solution target to target which will be more efficient. Thirdly, many opportunities are easily ignored by the company, but SWOT analysis will have a function of reminding and decision maker will more emphasis the opportunities company has. Fourthly, after knowing the treats company faced, it is good for employees in the company to understand how to deal with the treats and have the preparation for the threats.

3.3.1 Strengths of Škoda

We will introduce the strengths of Skoda in this part.

Table 3.5 Sum of strengths of Škoda

Strengths
Customers' enjoyment and Satisfaction
Unique styling
Support from Volkswagen
Customer Relationship
Innovations

We sum up our company's strengths in to 5 parts

1: Customers' enjoyment and Satisfaction

In the strategy of Skoda's selling, it is different from the purpose of maximizing the revenues from selling. It keeps the quality and function, which make customers enjoy in the products and satisfies the customers. Added, Skoda will back to inquire the experience from their customers who have bought the car for 6 months.

2: Unique styling:

The cars produced by Skoda has a special styling differently from other company's cars that some of the cars are look sharp from all sides and some of the cars are look wider. The style of the car its depends on the usage of the car and type of the cars. These special designs improve the ability in competition.

3 Support from Volkswagen:

Skoda is corporate with Volkswagen which has good experience and technology on car production. With the support from Volkswagen, Skoda can produce and innovate car better and better.

4 Customer Relationship:

Skoda is always famous for the good relationship with the customers. By the reason that Skoda has a good after sale service. With collection of the customers feedbacks and strict acquirements for the employments in selling, Skoda has a good relationship with customers.

5. Innovations

Skoda never gives up the innovation for new cars, new function and new experience for customers. That's why, we can see Skoda launches new product each year. In a word, innovation is a strong strength for Skoda.

3.3.2 Weaknesses of Škoda

Then, we will introduce the weakness of Skoda.

Table 3.6 Sum of weaknesses of Škoda

Weaknesses
High maintenance cost
Poor presence in value segments
Poor distribution channels
Pricing

From table 3.6, we sum the weakness in to four points.

1. High maintenance cost.

Every year, Skoda will spend much money on the maintain production equipment. So, how to make the produce be more efficient and decrease the maintain cost is a very important problem need to solve for Skoda.

2. Poor presence in value segments:

Skoda's presence in value segment is very limited like in the area of hatchback car. It need to expand their brands of car to more areas.

3. Poor distribution channels:

Although Skoda can sell cars to many foreign countries, it still is lack of distribution channels in countries like India or China. If Skoda has more distribution channel, it can directly increase the sales.

4. Pricing

The customers which faced to Skoda are mainly at middle price level. Skoda need to launch some flagship product to appeal customers with high consumption.

3.3.3 Opportunities of Škoda

In this part, we introduce the opportunities faced to Skoda.

Table 3.7 Sum of opportunities faced by Škoda

Opportunities
Customer experience
Differentiate
High market potential
Transition Customers
Corporation

We sum the opportunities to five points in table 3.7.

1. Customer experience.

Like we mentioned in the strengths of Skoda, it should to keep and improve the level of good customer experience. It is a good way to improve the sales.

2. Differentiate

Skoda should make more special idea on the design of the car and this will differentiate its brand from other.

3. High market potentials for small cars:

With more people own cars, it will be more traffic in the city. It will have a market potential for small cars by the reason that small car will have lower volume and easily to through the crowded road.

4. Transition Customers:

With the income of Skoda company's customers increased, they would like to change the car with high level like SUV. So, Skoda as a car producer with good relationships with customers should catch this opportunity.

5. Corporation

Corporation with other companies is a good opportunity to exchange the experience and technologies and increase the market share.

3.3.4 Threats of Škoda

At last, we will introduce the treats faced by the Skoda.

Table 3.7 Threats faced by Škoda

Threats
Cheaper price from competitors
Competition with other brands
Innovation speed

We sum the treats faced by Skoda in 3 points.

1. Cheaper price from competitor

The first Treat is the potential probability that competitors sell the cars in same level with cheaper price. So, it is necessary for Skoda to collect the information from competitor and use better marketing strategy.

2. Competition with other brands

Skoda faces treat from brands like Honda, Toyota, Nissan and so on, which are also international brand in the world. So, how to enhance Skoda's special characteristics and quality is a very important part for the company's owners.

3 Innovation speed

The third treat for Skoda is about the innovation speed. Nowadays every industry develops in a high speed. Skoda needs to follow the change of industry and increases the speed of innovation.

4. Application of the CorporateMetrics Methodology

In this chapter, we will apply the methods we have mentioned in the chapter 2 to estimate our company's net operating incomes in 2018.

4.1 Prediction of market exchange rate

In our thesis, our company has operating revenues from 3 foreign countries, which are China, Europe and UK. We will predict each exchange rate separately in the followed parts.

4.1.1 Exchange rate of CZK/RMB

When Skoda sells cars in China, company will get operating revenues in RMB. In our thesis, we assume the operating revenues in China will transfer to CZK every week, so we need to predict the exchange rate CZK/RMB. Followed is the history trend of CZK/RMB and the procedure of prediction.

4.1.1.1 History trends of exchange rate of RMB

The time interval we find is weekly interval. The data is start from 5th January 2013 and end at 30th December 2017 and totally numbers of data is 261 weekly exchange rates.

Chart 4.1 Weekly exchange rate of CZK/RMB from 5th January 2013 to 30th December 2017

(Source: https://www.exchangerates.org.uk/CNY-CZK-exchange-rate-history.html)

From chart 4.1, we can clearly see that from first week to 141th week, the trend is increased overall but after that the trend starts to decrease drastically. Then we will use Geometric

Brownian motion which we mentioned in 2.2.1 to predict exchange rate. The time period we want to predict are the weekly exchange rate in 2018 which include 52 weeks.

For applying the method that we need to calculate the parameters included in to the function 2.7, which are trend coefficient ($\alpha_{CZK/RMB}$), standard deviation ($\sigma_{CZK/RMB}$), interval ($\Delta t_{CZK/RMB}$) and initial exchange rate ($E_{0_{CZK/RMB}}$). The results are followed:

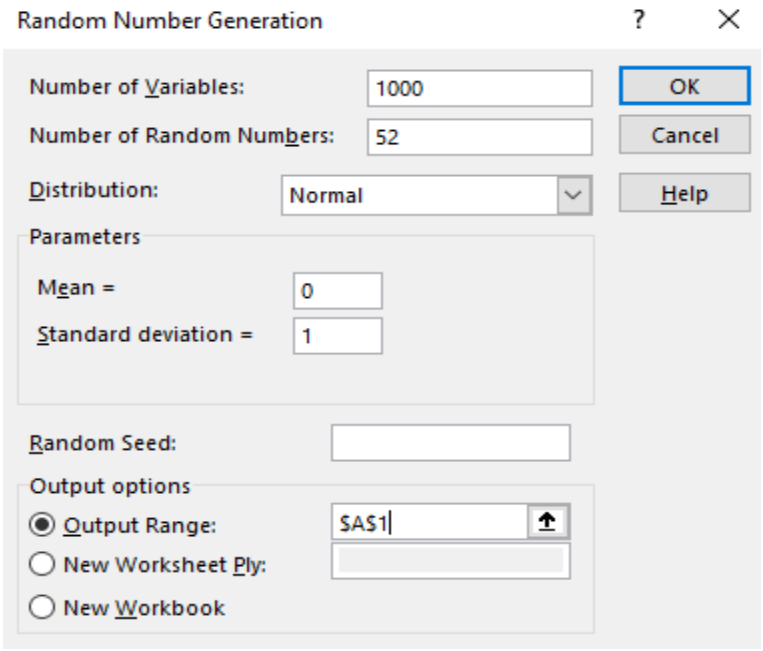
Table 4.1 Parameters used for simulating random evolution of CZK/RMB

$\sigma_{CZK/RMB}$	$\alpha_{CZK/RMB}$	$\Delta t_{CZK/RMB}$	$E_{0_{CZK/RMB}}$	numbers of steps
1.251%	-0.026%	1	3.119	261

4.1.1.2 Simulation of the Random Evolution of exchange Rate of CZK/RMB

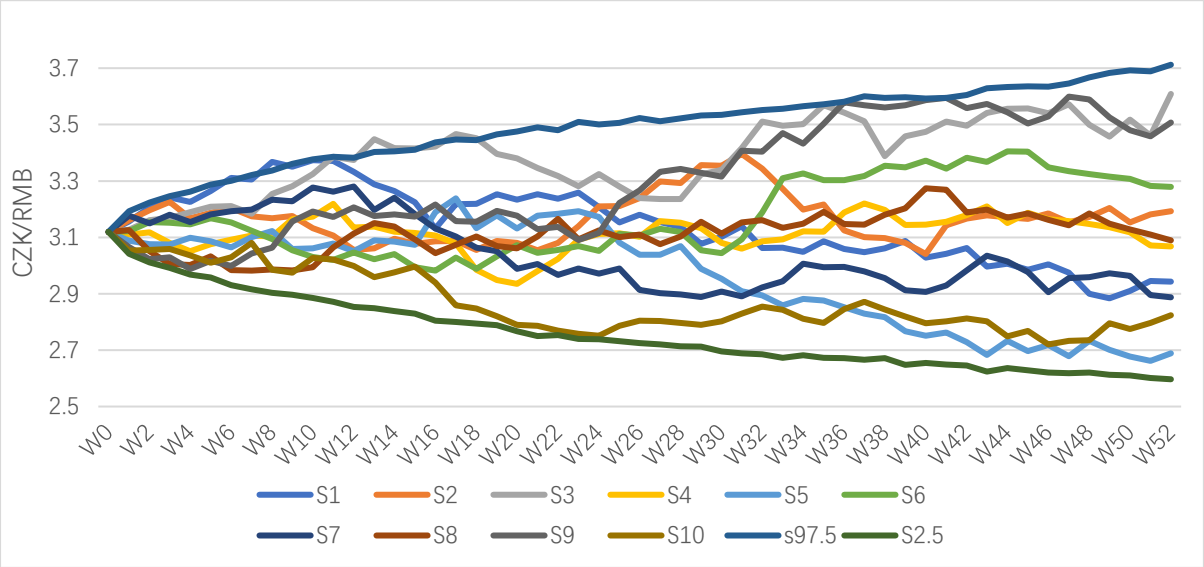
For simulation of the random evolution of exchange rate, we will generate 1000 scenarios random number first. By the methodology in chapter 2.2.1 mentioned, we will generate random numbers in each scenario with standard normal distribution. Each scenario has 52 number by the reason that we want to predict 52 weeks exchange rate in 2018.

Chart 4.2 Random number generation with standard normal distribution



Then we can use the parameters in table 4.1 and the random number ($\tilde{z}$) to get final results.

Chart 4.3 Sample of 10 scenarios of exchange random evolution of *CZK/RMB*



From 1000 scenarios, we select first 10 scenarios as the sample help us to observe. In our sample, we predict exchange rate in the year 2018 for each week which we have 52 weeks future exchange rates. We can't clearly see the trend is decreased or increased, because the trend coefficient α is -0.026% which is very close to zero.

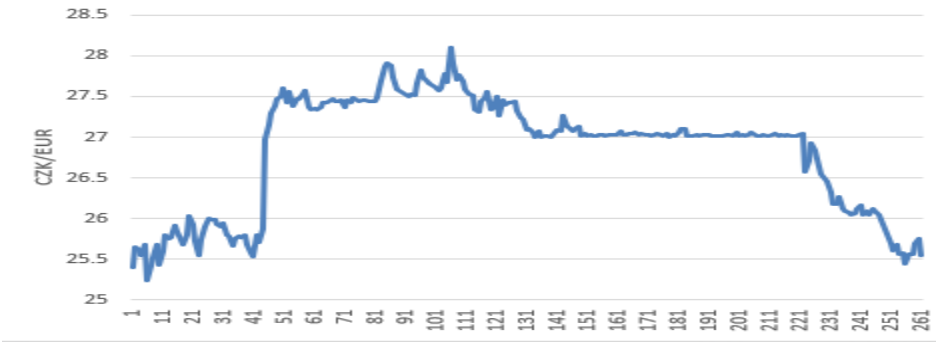
4.1.2 Exchange rate of CZK/EUR

When Skoda sells cars in Europe, company will get operating revenues in EUR. In our thesis, we assume the operating revenues in Europe will transfer to CZK every week, so we need to predict the exchange rate CZK/EUR. Followed is the history trend of CZK/EUR and the procedure of prediction.

4.1.2.1 History trend of exchange rate of EUR

The time interval for CZK/RMB,is also weekly interval. The data also is start from 5th January 2013 and end at 30th December 2017 and totally numbers of data is 261 weekly exchange rates.

Chart 4.4 Weekly exchange rate of CZK/EUR from 5th January 2013 to 30th December 2017



(Source: https://www.exchangerates.org.uk/EUR-CZK-exchange-rate-history.html)

From chart 4.4, we can clearly see that from first week to 41th week, the trend does not change to much, but from 41th week to 51 weeks, there has a big increase on the exchange rate, which means CZK depreciate a lot. Then CZK appreciates a lot after 221th week which represent on the trend is decreased. Then we will apply use Geometric Brownian motion which we mentioned in 2.2.1 to predict exchange rate. We will apply the method to predict CZK/EUR weekly exchange rate in 2018, which includes 52 weeks.

For applying the method we need to calculate the parameters included in to the function 2.7, which are trend coefficient ($\alpha_{CZK/EUR}$), standard deviation ($\sigma_{CZK/EUR}$), interval ($\Delta t_{CZJ/EUR}$) and initial exchange rate ($E_{0_{CZK/EUR}}$). The results are followed:

Table 4.2 Parameters used for simulating random evolution of CZK/EUR

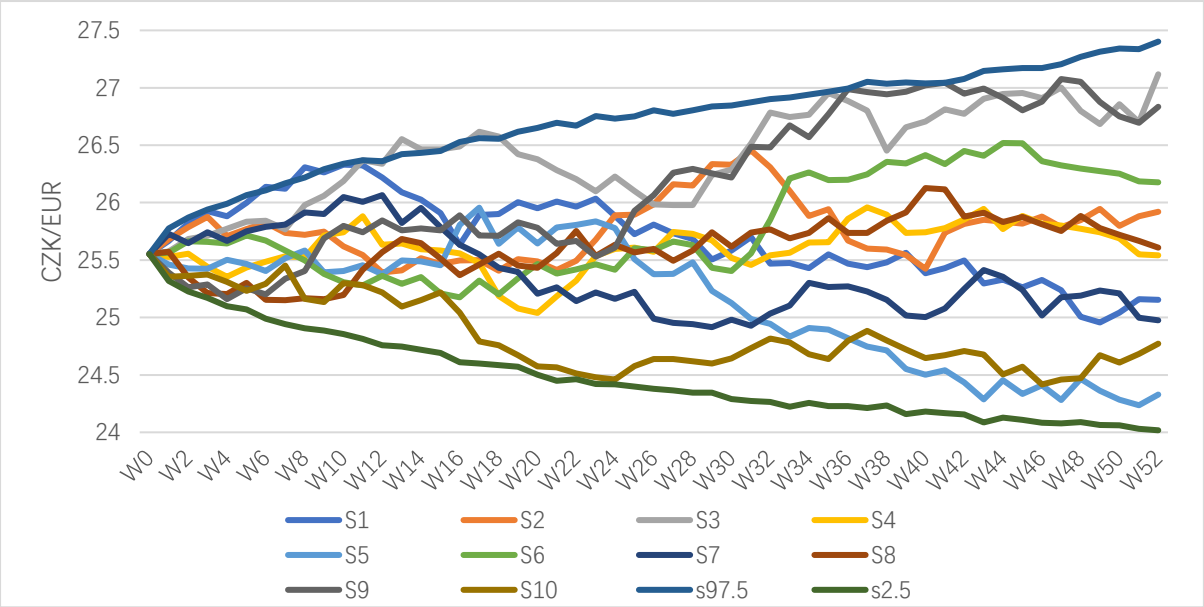
$\sigma_{CZK/EUR}$	$\alpha_{CZK/EUR}$	$\Delta t_{CZK/EUR}$	$E_{0_{CZK/EUR}}$	numbers of steps
0.46%	0.001%	1	25.552	261

4.1.2.2 Simulation of the Random Evolution of exchange Rate

The process is like what we apply in chapter 4.1.1.2, we will generate 1000 scenarios random number and then do the prediction of exchange rate.

We use the parameters in table 4.1 and the random number ($\tilde{z}$) to get final results.

Chart 4.5 Sample of 10 scenarios of exchange random evolution of CZK/EUR



It is like the prediction of exchange rate CZK/EUR, we make 1000 scenarios future exchange rate prediction for CZK/EUR and we select first 10 scenarios as the sample help us to observe. In our sample, we predict exchange rate of CZK/EUR in the year 2018 for each week that we have 52 weeks future exchange rates for each scenario. By the reason of the trend coefficient α is 0.001%, We can't see the trend is decreased or increased.

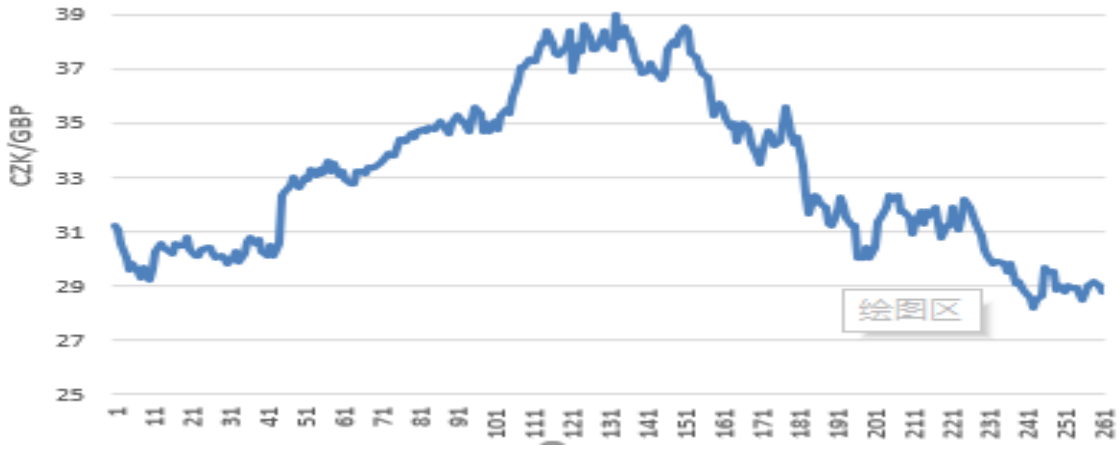
4.1.3 Exchange rate of CZK/GBP

When Skoda sells cars in UK, company will get revenues in GBP. In our thesis, we assume the revenues in UK will transfer to CZK every week, so we need to predict the exchange rate CZK/EUR. Followed is the history trend of CZK/EUR and the procedure of prediction.

4.1.3.1 History trend of exchange rate of GBP

The time interval for CZK/GBP is weekly interval, too. The history data is same with other 2 exchange rate we have predicted that starts from 5th January 2013 and end at 30th December 2017 and totally numbers of data is 261.

Chart 4.6 Weekly exchange rate of CZK/GBP from 5th January 2013 to 30th December 2017



(Source: https://www.exchangerates.org.uk/GBP-CZK-exchange-rate-history.html)

From chart 4.6, we can clearly see that there exist 2 trends in overall. The weekly exchange rate of CZK/GBP starts to increase at initial and the peak is at 131th week. Then the trend starts to decrease last until the end. Then we will apply use Geometric Brownian motion which we mentioned in 2.2.1 to predict exchange rate like what we do in the previews parts. We will apply the method to predict CZK/GBP weekly exchange rate in 2018, which includes 52 weeks.

For applying the method that we need to calculate the parameters included in to the function 2.7, which are trend coefficient ($\alpha_{CZK/GBP}$), standard deviation ($\sigma_{CZK/GBP}$), interval ($\Delta t_{CZK/GBP}$) and initial exchange rate ($E_{0_{CZK/GBP}}$). The results are followed:

Table 4.3 Parameters used for simulating random evolution of CZK/GBP

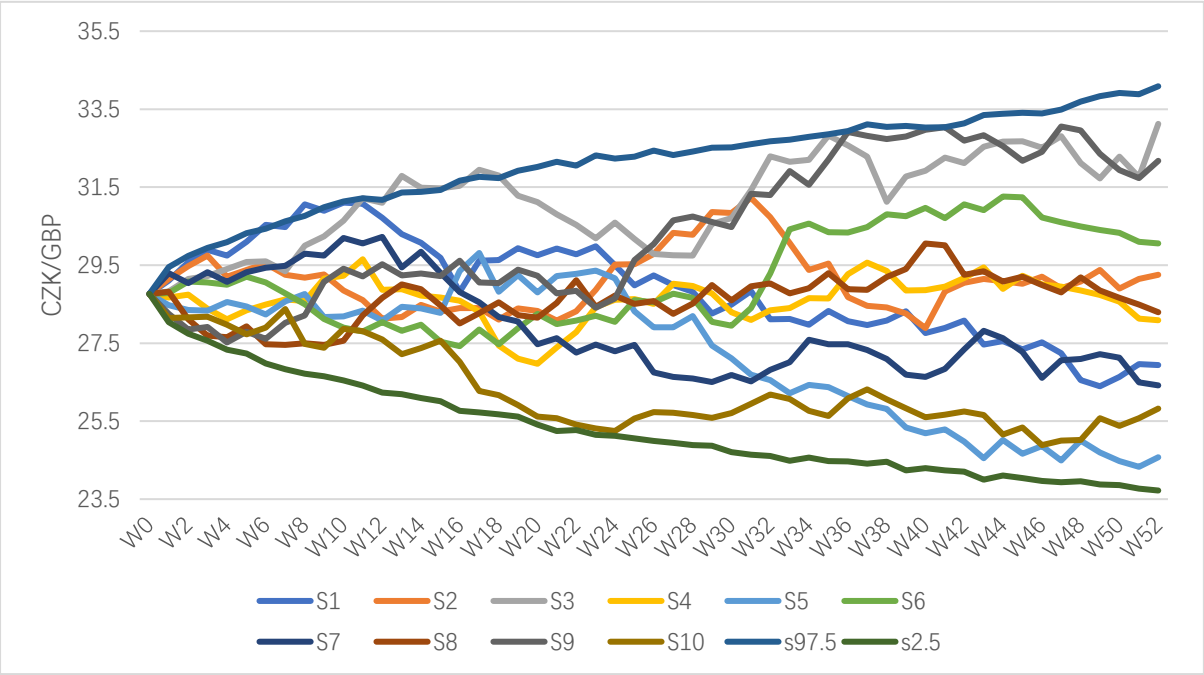
$\sigma_{CZK/GBP}$	$\alpha_{CZK/GBP}$	$\Delta t_{CZK/GBP}$	$E_{0_{CZK/GBP}}$	numbers of steps
1.27%	-0.040%	1	28.764	261

4.1.2.2 Simulation of the Random Evolution of CZK/GBP

The process is like what we apply in chapter 4.1.1.2 and chapter 4.1.2.2, we generate 1000 scenarios random number and then do the prediction of exchange rate CZK/GBP.

We use the parameters in table 4.3 and the random number ($\tilde{z}$) we generate to get final results.

Chart 4.7 Sample of 10 scenarios of exchange random evolution of CZK/GBP



It is like the prediction in previews parts, we make 1000 scenarios future exchange rate prediction for CZK/GBP and 10 scenarios which is the first 10 in the total scenarios are selected to observe. In our sample, the prediction of exchange rate CZK/GBP is for the year 2018 with 52 weekly exchange rates. We can see 10 scenarios have a slightly decrease and except 1 scenario, all the other is on the range of 2.5% coefficient percentile and 97.5% coefficient percentile.

4.2 Prediction of consolidated operating revenue

In our thesis, our goal is to predict companies net operating income, by the method mentioned in chapter 2.3, we need to predict company's future operating revenue and the operating cost. In this chapter, we focus on the prediction of operating revenue. With company is an international company. The operating revenue is come from different country, so we should predict operating revenues in different countries separately and then transfer to the CZK.

4.2.1 Prediction of average car price

By the function 2.14, we know operating revenue is calculated by average price time the quantity sold in the country. We should predict price and quantity firstly and then calculate revenues. In this part, we aim to predict the average price in each country's currency.

4.2.1.1 Average car price in CZK

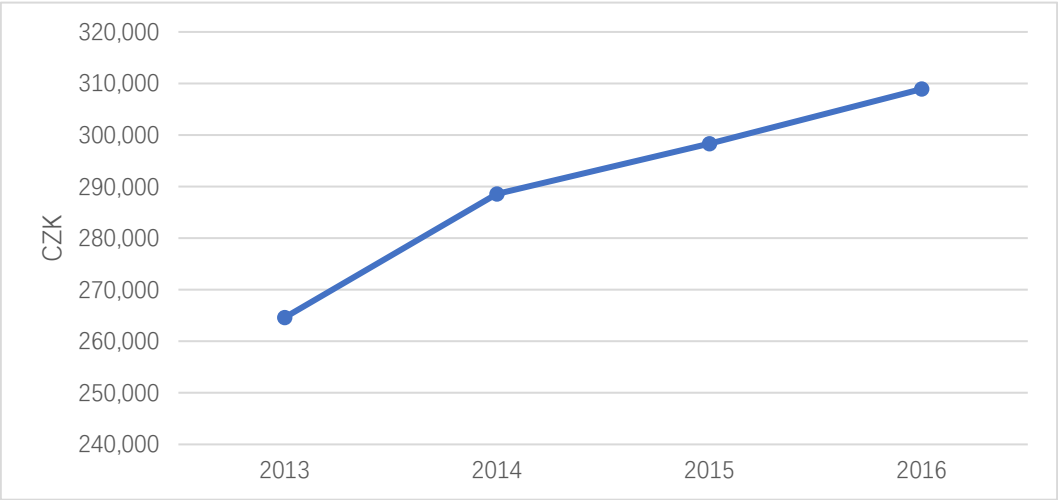
We firstly start to predict the average price in CZK.

Table 4.4 Average car price during 2013 to 2016

	Operating revenues in CZK	Q be sold	Average price in CZK
2013	**243,624,000,000**	**920,750**	**264,593**
2014	**299,318,000,000**	**1,037,226**	**288,575**
2015	**314,897,000,000**	**1,055,501**	**298,339**
2016	**347,987,000,000**	**1,126,477**	**308,916**

We can find the consolidated operating revenues and the quantity of car be sold for each year in company's financial annual reports. Here, for a simplification which we mentioned in chapter 2.5, we calculate average price with consolidated operating revenues divided by total quantity be sold and use this average price as the price of each car which company sells.

Chart 4.8 Trend of average car price



From chart 4.8, we can see that the trend of average car price in CZK is decreasing from 2013 to 2016, which is from 264,593 CZK to 308,916 CZK about 16.8% increase in price. It is a good situation for our company, high price means the probability of high incomes.

Then we can use the average growth rate which is the method of prediction we mentioned in chapter 2.2.2 to predict the average car price in 2018.

Table 4.5 Prediction of average car price in CZK in 2018

Average price	CZK	k
2013	**264,593**	
2014	**288,575**	0.0906392
2015	**298,339**	0.0338331
2016	**308,916**	0.035454
		0.0533088
2017	**325,384**	
2018	**342,730**	

By apply the prediction method of average growth rate, we can easily get the future average car price is 342,730 CZK in 2018.

4.2.1.2 Average price in foreign country

Our company set foreign car price in the first day of each year with the average exchange rate in the past year. So, if we want to predict each average car price in foreign currency, we need to know the average exchange rate for each currency.

Table 4.6 Average exchange rate of foreign currency in 2017

Average exchange rate	CZK/RMB	CZK/EUR	CZK/GBP
2017	3.449	26.309	30.025

Here, we give 3 exchange rates of foreign currency to CZK in table 4.6. Then we can calculate foreign car price with them.

Table 4.7 Average car price for each foreign country

2018	China	Europe	UK
Average price	**99,377**	**13,027**	**11,415**
Currency	RMB	EUR	GBP

After calculation, we get the foreign average car price in 2018, which is 99,377 RMB in China, 13,027 EUR in Europe and 11,415 in UK.

4.2.2 Prediction of quantity of car being sold

After prediction of average car price in each country, then we need to focus on the prediction of quantity of car being sold in each country

4.2.2.1 History trends of car being sold in each country

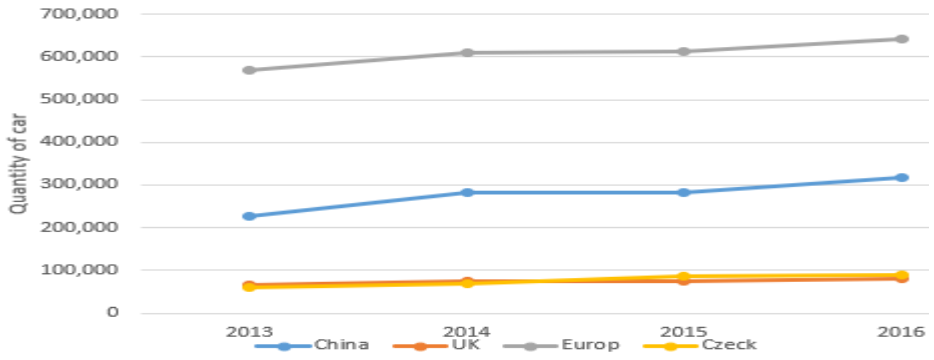
The prediction should be based on the history data, in this part we will show you the condition in history.

Table 4.8 Quantity of car being sold during 2013 to 2016

Q being sold	China	UK	Europe	Czech
2013	**226,971**	**66,029**	**567,708**	**60,042**
2014	**281,412**	**76,027**	**609,587**	**70,200**
2015	**281,707**	**74,879**	**613,910**	**85,005**
2016	**317,088**	**80,325**	**641,048**	**88,016**

From table 4.8, we can clearly see each quantity of car being sold for each country from 2013 to 2016. Then we can see the trends of each country's condition by followed chart.

Chart 4.9 Trends of quantity of car being sold in each country during 2013 to 2016



From chart 4.9, we can know that each trend is increased from 2013 to 2017. For the quantity of car being sold in China, the number is increased from 226,971 to 317,088 cars, which increased nearly 100,000 cars and increase 50% quantity compare to the quantity in 2013. For the quantity of car being sold in Europe, the number is increased from 66,029 to 80,325, which increased 80,000 cars during 2013 to 2015 and it is increased about 15% compared to the quantity in 2013. For the quantity of car being sold in UK and Czech, the number of quantity and the trends are very similar. In UK, the quantity is increased from 66,029 to 80,325 cars and it is increased from 60,042 to 88016 cars in Czech.

4.2.2.2 Prediction of quantity of car being sold in each country

With the history data, we can apply the prediction method we mentioned on chapter 2.2.2, which is average growth rate to predict the quantity of car being sold in 2018.

Table 4.9 Prediction of quantity of car being sold in China

Q being sold	China	**k**
2013	**226,971**	
2014	**281,412**	**0.239859**
2015	**281,707**	**0.001048**
2016	**317,088**	**0.125595**
		0.122167
2017	**355,826**	
2018	**399,296**	

Table 4.9 reflects the results of the future quantity of car being sold in China, which there will be 399,296 cars be sold in China.

Table 4.10 Prediction of quantity of car being sold in Europe

Q being sold	Europe	**k**
2013	**567,708**	
2014	**609,587**	**0.073769**
2015	**613,910**	**0.007092**
2016	**641,048**	**0.044205**
		0.041688
2017	**667,772**	
2018	**695,611**	

We can see our prediction results of quantity of cars being sold in Europe is 695,611 in years of 2018.

Table 4.11 Prediction of quantity of car being sold in UK

Q being sold	UK	**k**
2013	**66,029**	
2014	**76,027**	**0.151418**
2015	**74,879**	**-0.0151**
2016	**80,325**	**0.072731**
		0.069683
2017	**85,922**	
2018	**91,910**	

From table 4.11, we can know that, in 2018, there are 91,910 cars are predicted to be sold.

Table 4.12 Prediction of quantity of car being sold in Czech

Q being sold	Czech	**k**
2013	**60,042**	
2014	**70,200**	**0.169182**
2015	**85,005**	**0.210897**
2016	**88,016**	**0.035421**
		0.1385
2017	**100,206**	
2018	**114,085**	

As the results shown on the table 4.12, the numbers of quantity of cars predicted to be sold in Czech is 114,085 in 2018.

4.2.3 Prediction of operating revenue from each country in 2018

In chapter 4.2.1 and chapter 4.2.2, we have predicted the average car price and the quantity of cars being sold in 2018. In this part, we can do the estimation of consolidated operating revenues.

4.2.3.1 Estimate the operating revenues from China

Our company will sell car in China and receive operating revenues by the selling. What need to mentioned is that our company transfers the operating revenue from RMB to CZK at the end of each week. We also assume in the chapter 2.5, the quantity of car being sold each week is same. Before calculation, let we do a summarize of data we have.

Table 4.13 Summarize data of condition in China

2018	China
Average price	**99,377 RMB**
Quantity of car being sold(totally)	**399,296**

Then we can calculate the weekly quantity being sold in China and weekly operating revenues in RMB in the 2018.

Table 4.14 Weekly operating revenues from China in RMB

2018	China
Weekly sold	**7,679**
Average car price in RMB	**99,377**
Weekly operating Revenues in mill RMB	**763**

From table 4.14, we can know the weekly operating revenues is 763 million RMB. If we want to transfer the operating revenues from RMB to CZK, we need to use the weekly operating revenues in RMB time to the exchange rate CZK/RMB. It has 52 weeks in 2018, so the processes of the transformation will be 52. So, after summing the 52 transformation operating revenues in CZK, we can get the consolidated operating revenues from China in 2018.

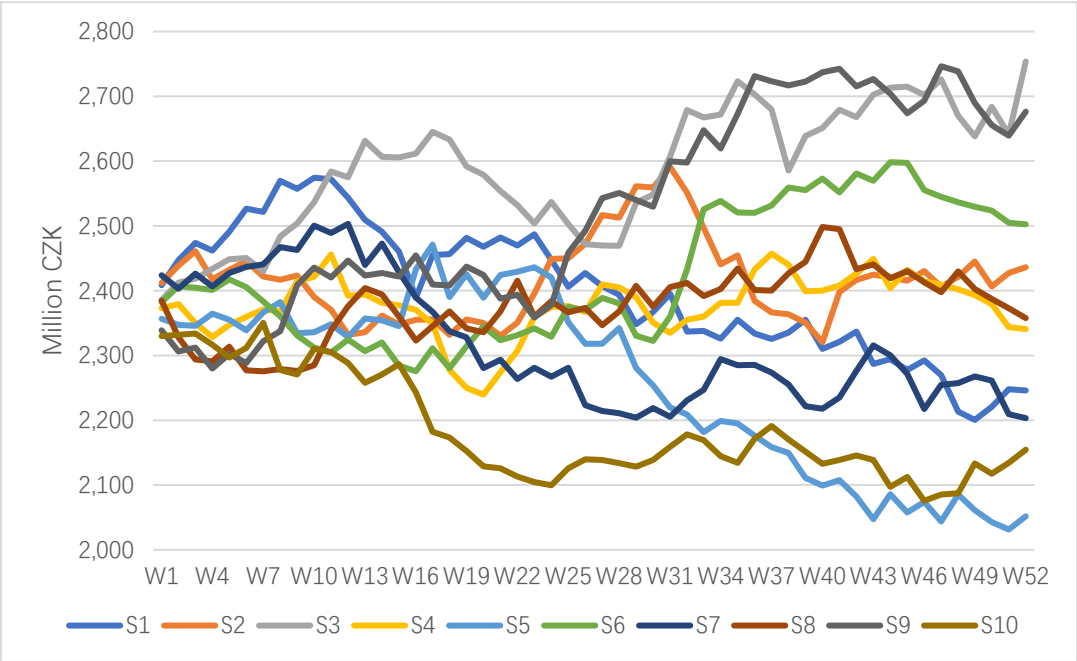
Table 4.15 Transformation of operating revenues from China in CZK

Operating revenues from China	Year of 2018							
	W1	W2	W3	…	W50	W51	W52	SUM
Scenario 1	**2,408**	**2,447**	**2,474**	**…**	**2,221**	**2,248**	**2,246**	**124,712**
Scenario 2	**2,412**	**2,439**	**2,461**	**…**	**2,406**	**2,427**	**2,436**	**125,721**
Scenario 3	**2,386**	**2,412**	**2,418**	**…**	**2,684**	**2,641**	**2,754**	**134,588**
Scenario 4	**2,373**	**2,379**	**2,350**	**…**	**2,379**	**2,344**	**2,341**	**123,560**
Scenario 5	**2,357**	**2,347**	**2,346**	**…**	**2,043**	**2,031**	**2,052**	**117,415**
Scenario 6	**2,382**	**2,407**	**2,405**	**…**	**2,524**	**2,505**	**2,502**	**126,076**
Scenario 7	**2,424**	**2,403**	**2,426**	**…**	**2,261**	**2,209**	**2,203**	**120,476**
Scenario 8	**2,385**	**2,328**	**2,294**	**…**	**2,387**	**2,373**	**2,357**	**123,553**
Scenario 9	**2,339**	**2,306**	**2,312**	**…**	**2,656**	**2,639**	**2,676**	**131,406**
Scenario 10	**2,330**	**2,332**	**2,334**	**…**	**2,117**	**2,134**	**2,155**	**113,689**

(Units of currency is in million CZK)

Like the results reflect on table 4.15, we select first 10 scenarios in 1000 scenarios of prediction for operating revenue from China in CZK. Then we make it into chart.

Chart 4.10 Transformation of operating revenues from China in million CZK



From chart 4.10, we can clearly see each trend of the weekly operating revenues after transformation in to CZK. Then for analysis the results furtherly, we need to do the frequency analysis.

Table 4.16 Preparation for frequency analysis for operating revenues from China

MIN	MAX	Equidistant interval	Numbers of steps
105,367	145,756	2,126	20

From table 4.16, we can know that the lowest value in 1000 scenarios of results is 105,367 and the biggest value is 145,756 and the equidistant interval value is 2,126 which is calculated by the function 2.19.

Table 4.17 Frequency analysis of operating revenues from China transfer to CZK

	Operating revenue in million CZK	Frequency	probability
I1	**105,367**	1	0.10%
I2	**107,493**	3	0.30%
I3	**109,619**	13	1.30%
I4	**111,744**	20	2.01%
I5	**113,870**	38	3.81%
I6	**115,996**	48	4.81%
I7	**118,121**	96	9.63%
I8	**120,247**	119	11.94%
I9	**122,373**	135	13.54%
I10	**124,499**	124	12.44%
I11	**126,624**	126	12.64%
I12	**128,750**	90	9.03%
I13	**130,876**	71	7.12%
I14	**133,002**	37	3.71%
I15	**135,127**	40	4.01%
I16	**137,253**	19	1.91%
I17	**139,379**	8	0.80%
I18	**141,505**	5	0.50%
I19	**143,630**	3	0.30%
I20	**145,756**	4	0.40%
Sum		1000	100%

Table 4.17 reflects the results of frequency analysis and we make it to the chart to observe the results clearly.

Chart 4.11 Frequency of operating revenues from China transfer to CZK

From chart 4.11, we can see each frequency of operating revenues and the frequency of operating revenues between 120,247 CZK to 122,373 is the most which is 135.

Chart 4.12 Probability of operating revenues from China transfer to CZK

From chart 4.12, we can know the probability distribution of our results from 1000 scenarios. The trend is similar to the trends of normal distribution which proves our results is correctly.

4.2.3.2 Estimate the operating revenues from Europe

When Skoda sells car in Europe, it will receive operating revenues with currency of EUR. Then at each end of week, it will transfer the operating revenue from EUR to CZK. Like we

assume in the chapter 2.5, the quantity of car being sold each week is same. Before we estimate the operating revenues from Europe, let we summarize data we have.

Table 4.18 Summarize data of condition in Europe

2018	Europe
Average price	**13,027 EUR**
Quantity of car being sold(totally)	**695,611**

Next, we will calculate the weekly quantity of cars being sold in Europe and weekly operating revenues in EUR in the 2018.

Table 4.19 Weekly operating revenues from Europe in EUR

2018	Europe
Weekly sold	**13,377**
Average car price in EUR	**13,027**
Weekly operating Revenues in mill EUR	**174**

From table 4.19, we can know the weekly operating revenues is 174 million EUR. Next, we use the weekly operating revenues in EUR time to the exchange rate CZK/EUR to get the weekly operating revenues in CZK. After calculation, we can get the consolidated operating revenues from Europe in 2018.

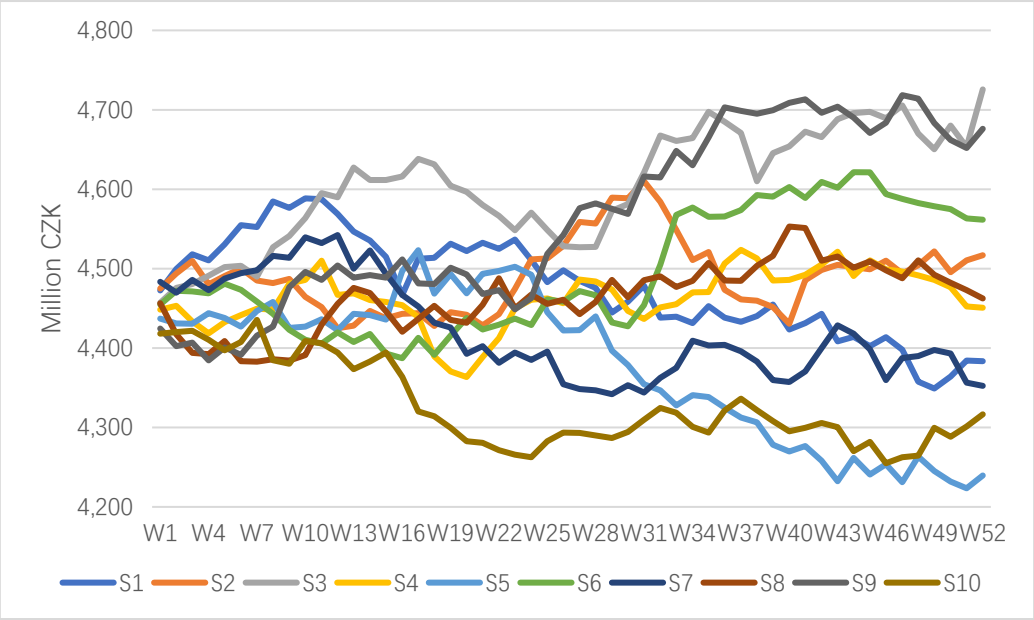
Table 4.20 Transformation of operating revenues from Europe

Operating revenues from Europe	Year of 2018							
	W1	W2	W3	…	W50	W51	W52	SUM
Scenario 1	**4,473**	**4,499**	**4,518**	**…**	**4,364**	**4,384**	**4,384**	**232,816**
Scenario 2	**4,475**	**4,494**	**4,509**	**…**	**4,495**	**4,510**	**4,517**	**233,544**
Scenario 3	**4,457**	**4,476**	**4,480**	**…**	**4,680**	**4,653**	**4,726**	**239,474**
Scenario 4	**4,448**	**4,453**	**4,433**	**…**	**4,477**	**4,452**	**4,451**	**232,063**
Scenario 5	**4,437**	**4,431**	**4,430**	**…**	**4,232**	**4,223**	**4,240**	**227,642**
Scenario 6	**4,455**	**4,472**	**4,471**	**…**	**4,575**	**4,563**	**4,562**	**233,761**
Scenario 7	**4,483**	**4,470**	**4,486**	**…**	**4,393**	**4,356**	**4,352**	**229,871**
Scenario 8	**4,457**	**4,417**	**4,394**	**…**	**4,482**	**4,473**	**4,462**	**232,058**
Scenario 9	**4,425**	**4,402**	**4,407**	**…**	**4,662**	**4,652**	**4,676**	**237,311**
Scenario 10	**4,418**	**4,420**	**4,422**	**…**	**4,288**	**4,301**	**4,317**	**225,014**

(Units of currency is in million CZK)

We can see the results from table 4.20, the first 10 scenarios in 1000 scenarios of prediction for operating revenue from Europe in CZK are given. Next, we can make it into chart.

Chart 4.13 Transformation of operating revenues from Europe



From chart 4.13, we can clearly see 10 different probabilities trends of the weekly operating revenues from Europe transferred to CZK. Next, we will do the frequency analysis to the results.

Table 4.21 Preparation for frequency analysis for operating revenues from Europe

MIN	MAX	Equidistant interval	Numbers of steps
105,367	145,756	2,126	20

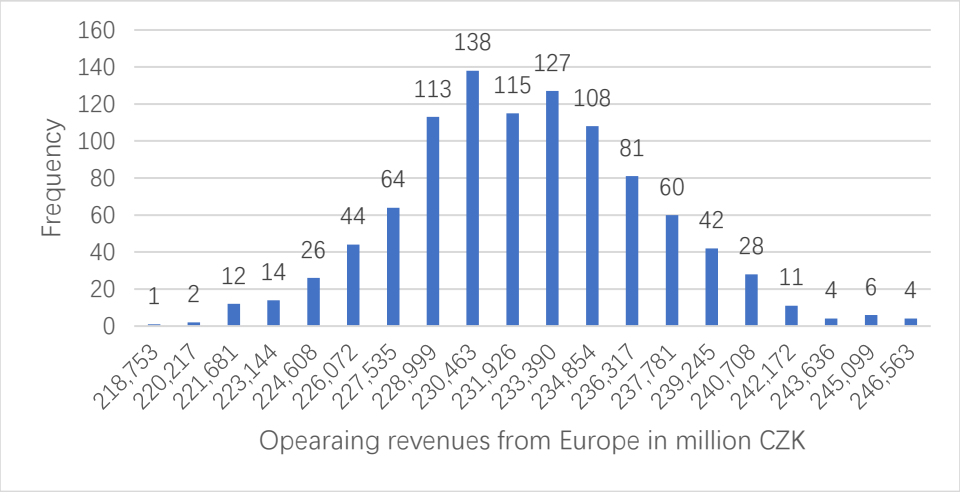
As table 4.21 clearly shown, the Min value of 1000 scenarios results is 218,753, the Max value is 246,563 and the value of equidistant interval is 1,464. Then we can start the frequency analysis.

Table 4.22 Frequency analysis of operating revenues from Europe transfer to CZK

	Operating revenue in million CZK	Frequency	probability
I1	**218,753**	1	0.10%
I2	**220,217**	2	0.20%
I3	**221,681**	12	1.20%
I4	**223,144**	14	1.40%
I5	**224,608**	26	2.61%
I6	**226,072**	44	4.41%
I7	**227,535**	64	6.42%
I8	**228,999**	113	11.33%
I9	**230,463**	138	13.84%
I10	**231,926**	115	11.53%
I11	**233,390**	127	12.74%
I12	**234,854**	108	10.83%
I13	**236,317**	81	8.12%
I14	**237,781**	60	6.02%
I15	**239,245**	42	4.21%
I16	**240,708**	28	2.81%
I17	**242,172**	11	1.10%
I18	**243,636**	4	0.40%
I19	**245,099**	6	0.60%
I20	**246,563**	4	0.40%
Sum		1000	100%

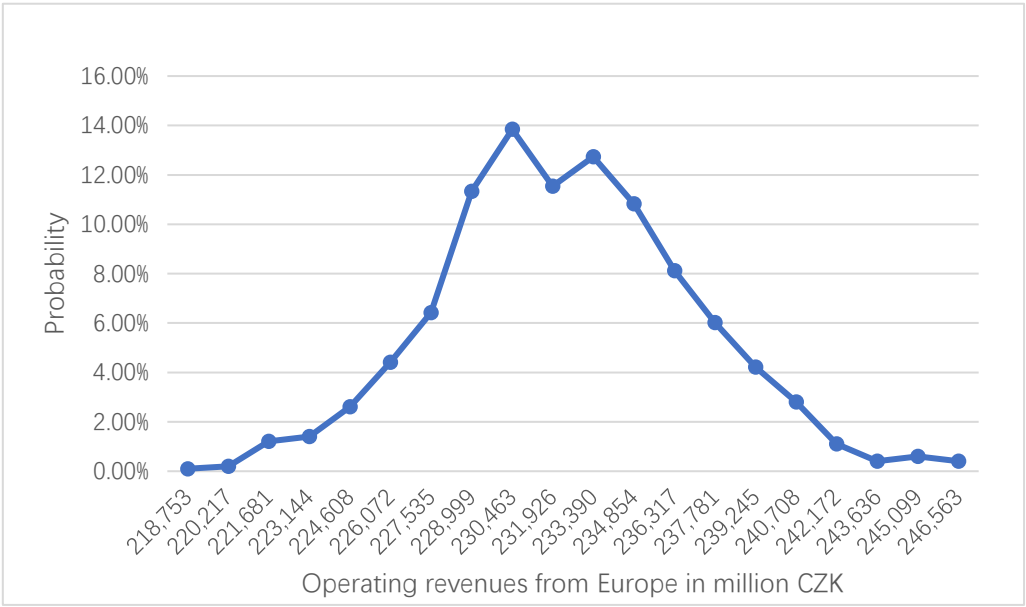
In table 4.22, we give the results of frequency analysis for operating revenues from Europe. Then we make the results into chart.

Chart 4.14 Frequency of operating revenues from Europe transfer to CZK



The Chart 4.14 reflects the frequency of 1000 results distributed in each interval. We can clearly find the interval with highest frequency is 228,999 to 230,463, which the frequency is 138.

Chart 4.15 Probability of operating revenues from Europe transfer to CZK



The Chart 4.15 reflect the probability distribution of the operating revenues from Europe. We can see that the trend is similar to the trend of normal distribution.

4.2.3.3 Estimate the operating revenues from UK

As our company sells cars to UK, it will receive operating revenues in GBP. With we mentioned in chapter 2.5, each end of week, our company will transfer the operating revenues from UK to currency in Czech, which is CZK.

Table 4.23 Summarize of data of condition in UK

2018	UK
Average price	**11,415 GBP**
Quantity of car being sold(totally)	**91,910**

With this data, we can calculate the weekly operating revenues from UK in 2018.

Table 4.24 Weekly operating revenues from UK in GBP

2018	UK
Weekly sold	**1,767**
Average car price in GBP	**11,415**
Weekly operating Revenues in mill GBP	**20**

From table 4.24, we can know the weekly operating revenues is 20 million GBP. Then we use the weekly operating revenues in GBP time to the exchange rate CZK/GBP to get weekly operating revenues from UK in CZK. There are 52 weeks in 2018, so we get 52 predicted operating revenues for each scenario.

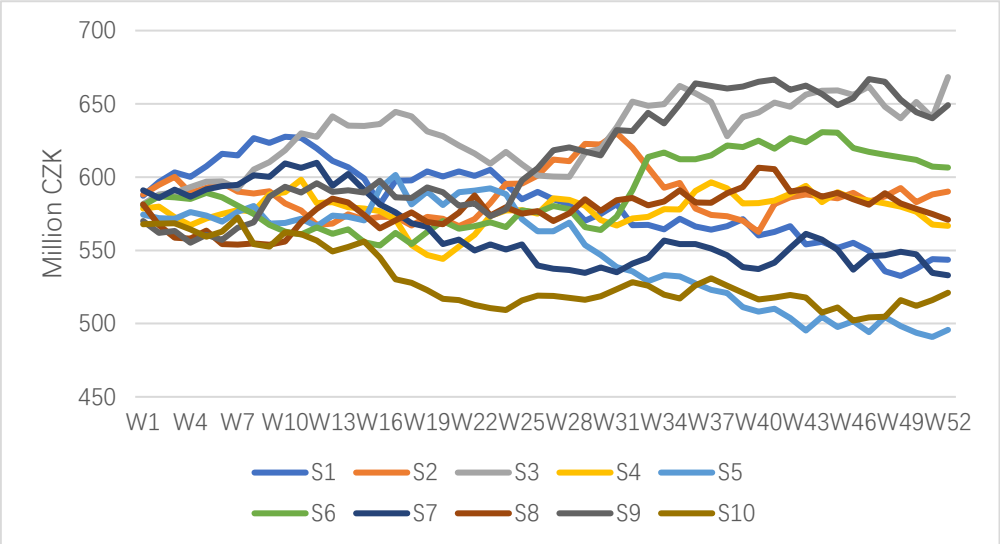
Table 4.25 Transformation of operating revenues from UK in CZK

Operating revenues from UK	Year of 2018							
	W1	W2	W3	…	W50	W51	W52	SUM
Scenario 1	**587**	**597**	**603**	**…**	**537**	**544**	**543**	**30,307**
Scenario 2	**588**	**595**	**600**	**…**	**583**	**588**	**590**	**30,553**
Scenario 3	**582**	**588**	**590**	**…**	**651**	**641**	**668**	**32,739**
Scenario 4	**578**	**580**	**573**	**…**	**576**	**568**	**567**	**30,020**
Scenario 5	**574**	**572**	**572**	**…**	**494**	**491**	**496**	**28,510**
Scenario 6	**581**	**587**	**586**	**…**	**612**	**607**	**606**	**30,639**
Scenario 7	**591**	**586**	**591**	**…**	**547**	**535**	**533**	**29,262**
Scenario 8	**581**	**567**	**559**	**…**	**578**	**575**	**571**	**30,018**
Scenario 9	**570**	**562**	**563**	**…**	**644**	**640**	**649**	**31,953**
Scenario 10	**568**	**568**	**569**	**…**	**512**	**516**	**521**	**27,591**

(Units of currency is in million CZK)

We can see from the table 4.15 that like what we do in the chapter 4.2.3.1 and chapter 4.2.3.2, the first 10 scenarios in 1000 scenarios of prediction are selected to be observed.

Chart 4.16 Transformation of operating revenues from UK in million CZK



From chart 4.16, the trends of different probabilities for weekly operating revenues from UK transfer to the CZK are given.

Table 4.26 Preparation for frequency analysis for revenues from UK

MIN	MAX	Equidistant interval	Numbers of steps
105,367	145,756	2,126	20

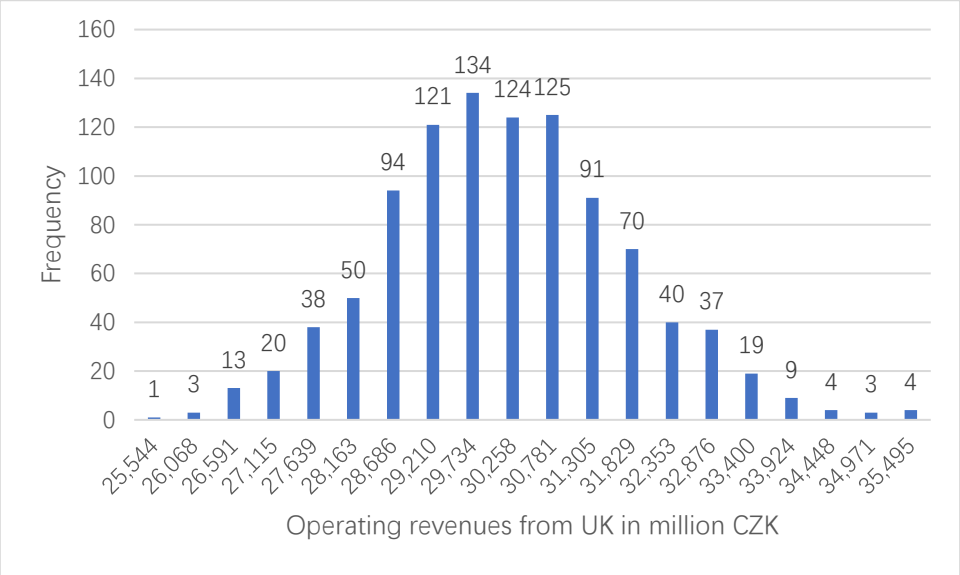
As the results reflected in table 4.26, the lowest and the biggest value is 25,544 and 35,495. The equidistant interval values is 524 and we have 20 steps. The results are as followed table shows.

Table 4.27 Frequency analysis of operating revenues from UK transfer to CZK

	Operating revenue in million CZK	Frequency	probability
I1	**25,544**	1	0.10%
I2	**26,068**	3	0.30%
I3	**26,591**	13	1.30%
I4	**27,115**	20	2.01%
I5	**27,639**	38	3.81%
I6	**28,163**	50	5.02%
I7	**28,686**	94	9.43%
I8	**29,210**	121	12.14%
I9	**29,734**	134	13.44%
I10	**30,258**	124	12.44%
I11	**30,781**	125	12.54%
I12	**31,305**	91	9.13%
I13	**31,829**	70	7.02%
I14	**32,353**	40	4.01%
I15	**32,876**	37	3.71%
I16	**33,400**	19	1.91%
I17	**33,924**	9	0.90%
I18	**34,448**	4	0.40%
I19	**34,971**	3	0.30%
I20	**35,495**	4	0.40%
Sum		1000	100%

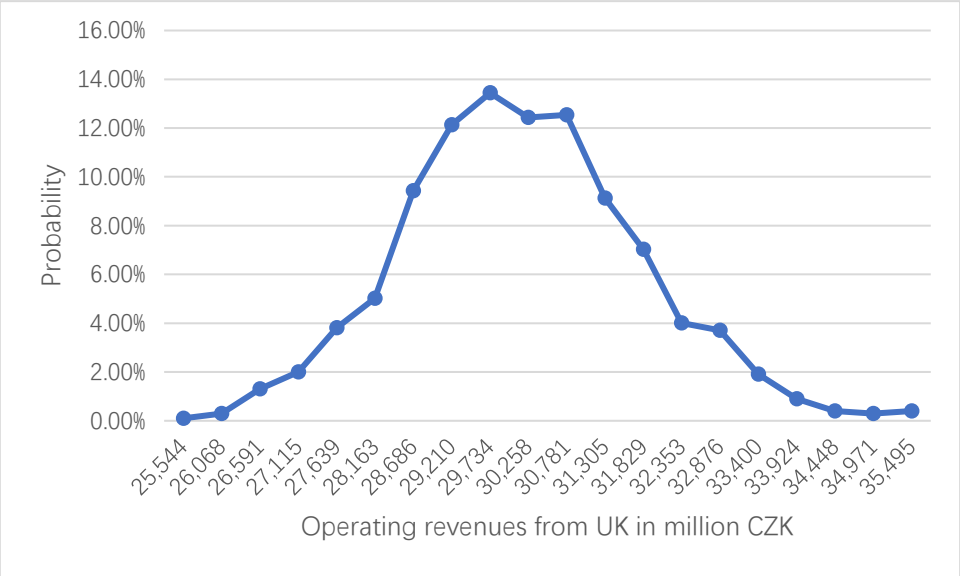
We can see the results of frequency analysis for operating revenues from UK, which includes frequency and probability of the 1000 scenarios results. Then, we can observe the results by the chart.

Chart 4.25 Frequency of operating revenues from UK transfer to CZK



Like what chart 4.25 shown, we can see the results of the frequency of our operating revenues distributed in each interval. The interval with the most frequency is 28,686 to 29,734 and its frequency is 134.

Chart 4.26 Probability of operating revenues from UK transfer to CZK



In the chart 4.26, we can know the trends of our results' distribution. It is distributed as the trend of normal probability distribution which confirmed our calculation is correct.

4.2.3.4 Estimate the operating revenues from Czech

Although our company is an international company, it also will sell cars in domestic and what different compare to sell to the foreign countries is that the revenues are received in domestic currency and company will not face the market risk from exchange rate.

Table 4.28 Summarize of data of condition in Czech

2018	Czech
Average price	**342,730 CZK**
Quantity of car being sold(totally)	**114,085**

With this data, we can calculate the weekly and totally operating from Czech in 2018.

Table 4.29 Weekly and totally operating revenues from Czech in CZK

2018	Czech
Weekly sold	**2,194**
Average car price in CZK	**342,730**
Weekly operating revenues in million CZK	**752**
Total operating revenues in million CZK	**39,100**

From table 4.29, we can know the weekly operating revenues from Czech in 2018 is 752 million CZK and the total operating revenues for 2018 is 39,100.

4.2.3.5 Summarize of total operating revenues

After we estimate the operating revenues from foreign countries and domestic country, we can estimate the consolidated operating revenues for our company.

For calculate the consolidate operating revenues we need to sum each operating revenue from different scenarios like function followed:

$$R_{W_t} = S_{w_t,China} + S_{w_t,Europe} + S_{w_t,Uk} + S_{w_t,Czech} \quad (4.1)$$

Where R_{W_t} is the consolidated operating revenues in week t of the 2018 and $S_{w_t,China}$ is the operating revenues from China in year of 2018. In 2018, there are 52 weeks, we sum the

operating revenues from each country and we will get the totally consolidated operating revenues in 2018.

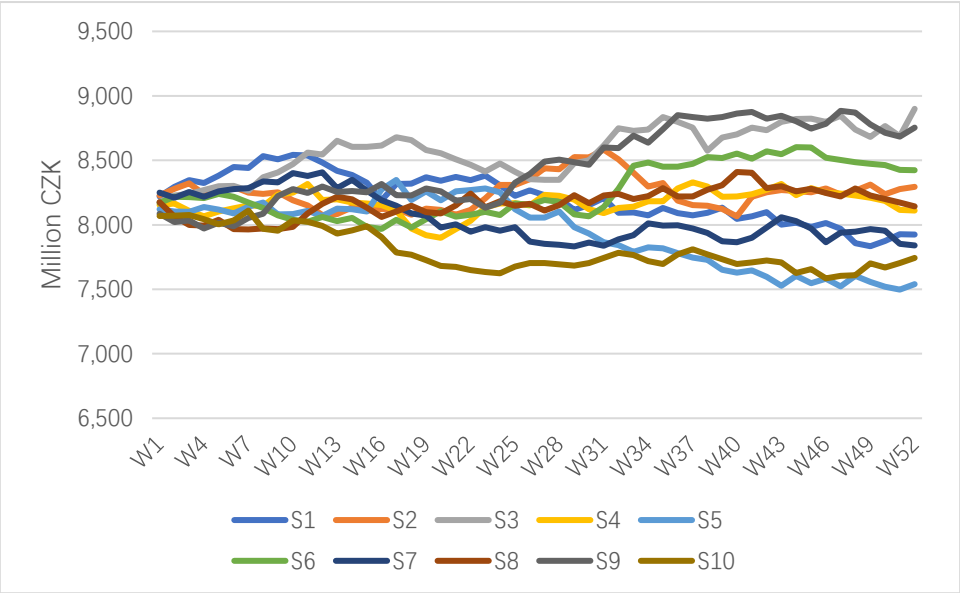
Table 4.30 Consolidated operating revenues in 2018

Consolidated operating revenues	Year of 2018							
	W1	W2	W3	…	W50	W51	W52	SUM
Scenario 1	**8,220**	**8,295**	**8,347**	**…**	**7,874**	**7,928**	**7,925**	**426,936**
Scenario 2	**8,227**	**8,279**	**8,322**	**…**	**8,237**	**8,278**	**8,295**	**428,918**
Scenario 3	**8,176**	**8,228**	**8,240**	**…**	**8,767**	**8,687**	**8,900**	**445,901**
Scenario 4	**8,152**	**8,164**	**8,108**	**…**	**8,184**	**8,115**	**8,110**	**424,744**
Scenario 5	**8,120**	**8,102**	**8,100**	**…**	**7,520**	**7,498**	**7,539**	**412,667**
Scenario 6	**8,170**	**8,218**	**8,214**	**…**	**8,463**	**8,427**	**8,422**	**429,577**
Scenario 7	**8,250**	**8,211**	**8,256**	**…**	**7,954**	**7,852**	**7,841**	**418,710**
Scenario 8	**8,175**	**8,065**	**7,998**	**…**	**8,199**	**8,172**	**8,143**	**424,729**
Scenario 9	**8,085**	**8,022**	**8,034**	**…**	**8,714**	**8,683**	**8,753**	**439,770**
Scenario 10	**8,068**	**8,072**	**8,076**	**…**	**7,670**	**7,703**	**7,744**	**405,394**

(Units of currency is in million CZK)

We can see from the table 4.30, we give the first 10 results from 1000 estimations after calculation. In order to observe furtherly, we will make it into chart.

Chart 4.27 Consolidated operating revenues in million CZK in 2018



From chart 4.27, we can see the different trends of consolidated operating revenues. Then we will do the frequency analysis to find the distribution of our company's results.

Table 4.31 Preparation for frequency analysis for consolidated operating revenues

MIN	MAX	Equidistant interval	Numbers of steps
105,367	145,756	2,126	20

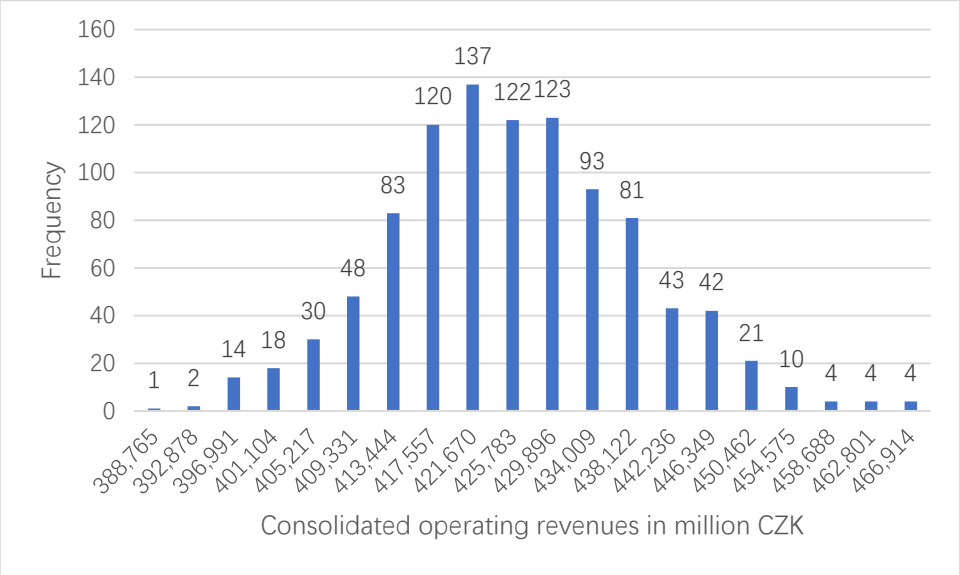
We can see from the table 4.31, the lowest operating revenues from our prediction is 466,914 and the highest operating revenues is466,914. The equidistant interval value is 4,113 and we have 20 steps.

Table 4.32 Frequency analysis of consolidated operating revenues in 2018

	Operating revenue in million CZK	Frequency	probability
I1	**388,765**	1	0.10%
I2	**392,878**	2	0.20%
I3	**396,991**	14	1.40%
I4	**401,104**	18	1.80%
I5	**405,217**	30	3.00%
I6	**409,331**	48	4.80%
I7	**413,444**	83	8.30%
I8	**417,557**	120	12.00%
I9	**421,670**	137	13.70%
I10	**425,783**	122	12.20%
I11	**429,896**	123	12.30%
I12	**434,009**	93	9.30%
I13	**438,122**	81	8.10%
I14	**442,236**	43	4.30%
I15	**446,349**	42	4.20%
I16	**450,462**	21	2.10%
I17	**454,575**	10	1.00%
I18	**458,688**	4	0.40%
I19	**462,801**	4	0.40%
I20	**466,914**	4	0.40%
Sum		1000	100%

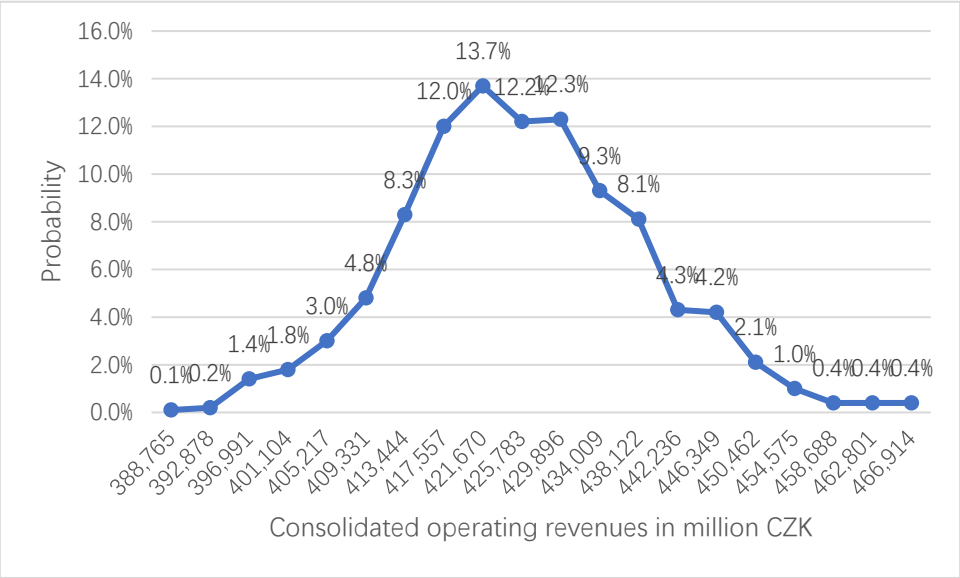
The Table 4.32 reflects the results of frequency analysis for consolidated operating revenues for our company. It includes results of frequency and probability of the 1000 scenarios results. Then, we also will make it into chart.

Chart 4.28 Frequency of consolidated operating revenues in 2018



We can clearly see from chart 4.28, the interval with the most frequency is 417,557 to 421,670 and its frequency is 137.

Chart 4.29 Probability of consolidated operating revenues in 2018



In the chart 4.29, the trend of our results' probability distribution is distributed as the trend of normal probability distribution. The highest probability for consolidated operating revenues our company will get in 2018 is between 417,557 million CZK to 421,670 CZK and the probability is 13.70%.

4.3 Prediction of total operating cost

As we mentioned in chapter 2.3, there are two parameters in total operating costs which is variables operating cost and fix operating cost. In this chapter, we will predict variable and fix cost separately and then sum them like the function followed.

$$\mathrm{TC}_{operating} = \mathrm{TVC}_{operating} + \mathrm{TFC}_{operating} \tag{4.2}$$

4.3.1 Prediction of variable operating cost

We start with the prediction of variable operating cost. The variable operating cost in the income statement is the cost of production and we use function followed to calculate the variables cost.

$$\mathrm{TVC}_{operating} = \bar{P} \cdot Q_{Total} \tag{4.3}$$

As the function 4.3 mentioned, we need to estimate the average operating cost for produce 1 car ($\bar{P}$) and the total quantity of car being produced (Q_{Total}).

4.3.1.1 Prediction of quantity of car un/over sale

In the previews parts, we predict the quantities which is being sold and for the estimation the total quantity of cars being produced, we still need to predict the quantity of cars un/over sales.

$$Q_{Total} = Q_{Being\,sold} + Q_{Un-sale} \tag{4.4}$$

The prediction is based on the history data, which is as followed:

Table 4.33 History of quantity of car un/over sale

Year	Un-sale/over- sale
2013	**9,871**
2014	**12,183**
2015	**-18,531**
2016	**25,831**

From the table 4.33, we can know the condition of quantity of car un/over sale in the year from 2013 to 2016. Then we will apply arithmetic mean with the function 2.18 to estimate the un/over sale quantity in the 2018.

Table 4.34 Prediction of quantity of un/over sale in 2018

Mean of quantity of car un/over sale in 2013 to 2016	**7,339**
Year of 2018	**7,339**

From table 4.34, we can know the arithmetic mean value of car un/over sale is 7,339 and we choose it as the quantity of car un-sale in the 2018.

4.3.1.2 Estimate the total quantity produced in 2018

We have the prediction of quantity of car being sold and car un-sale, after we sum them, the results will be the total quantity of car produced in Czech. We calculate with the function 4.4 and the results are as followed:

Table 4.35 Prediction of total quantity of car in 2018

	China	UK	Europe	Czech	Un/over sale	Total Q
2017	**355,826**	**85,922**	**667,772**	**100,206**	**7,339**	**1,217,065**
2018	**399,296**	**91,910**	**695,611**	**114,085**	**7,339**	**1,308,240**

From table 4.35, we can know the total quantity of cars produced in the Czech is 1,308,240 in 2018.

4.3.1.3 Prediction the operating cost per one car

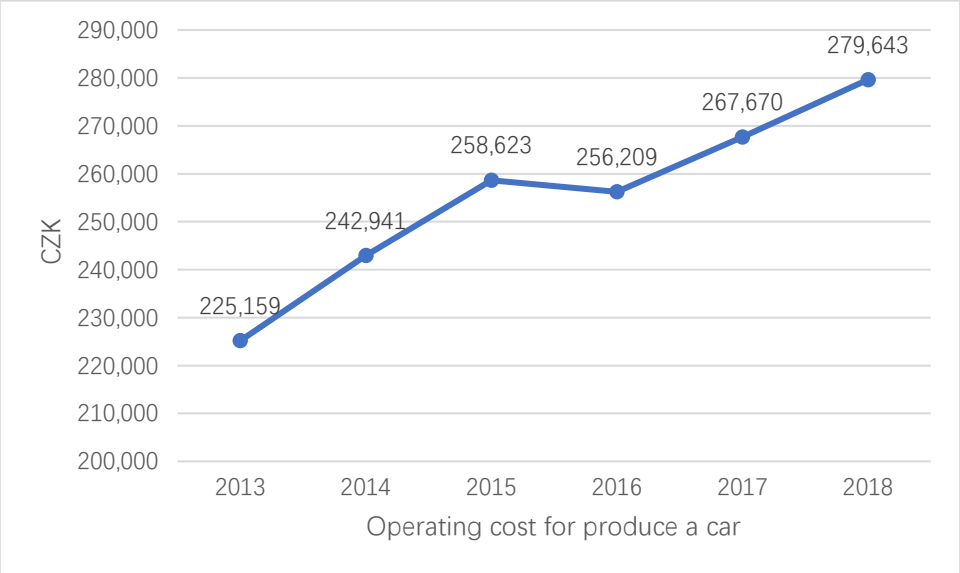
In the chapter 4.3.1.2, we estimate the total quantity of cars produced in Czech and in this part, we need to predict the average operating cost per 1 car and then we can calculate the total variable operating cost. We will apply average growth rate method which is mentioned on the chapter 2.2 section b and the results are as followed:

Table 4.36 Average operating cost for produce 1 car from 2013 to 2018

Average operating cost for produce 1 car		k
2013	**225,159 CZK**	
2014	**242,941 CZK**	0.078972
2015	**258,623 CZK**	0.064551
2016	**256,209 CZK**	-0.00933
		0.04473
2017	**267,670 CZK**	
2018	**279,643 CZK**	

From table 4.36, we can see history condition of our company's production. After calculating the average growth rate for the year from 2013 to 2016, we can get the results of average operating cost for produce one car in 2018. Then we can make it into chart.

Chart 4.30 Average operating cost for produce 1 car from 2013 to 2018



We can clearly see from the chart 4.30, the trend of average operating cost for produce a car is increased from 2013 to 2015, which is from 225,159 CZK per 1 car to 258,623 per 1 car. Then, it has a decrease to 256,209 CZK per 1 car in 2016. Then is the trend about our prediction average operating cost per 1 car for 2017 and 2018.

4.3.1.4 Calculation for variable operating cost in 2018

In chapter 4.3.1.2, we estimate the total quantity of cars will be produced in the 2018 and in chapter 4.3.1.3, we predict the average operating cost for produce 1 car. Then we just need to use the operating cost per one car time to the total quantity and we will get the total variable operating cost of our company in 2018.

Table 4.37 Prediction of total variable operating cost of company

	2017	2018
Operating cost per 1 car (CZK)	**256,209**	**279,643**
Total Q	**1,217,065**	**1,308,240**
Total variable cost (CZK)		**365,839,577,495**
Total variable cost (Million CZK)		**365,840**

From table 4.37, we can know the results of total variable operating cost in 2018 is about 365,840 million CZK.

We also prepare the results of total variable operating cost from 2013 to 2016 is as followed.

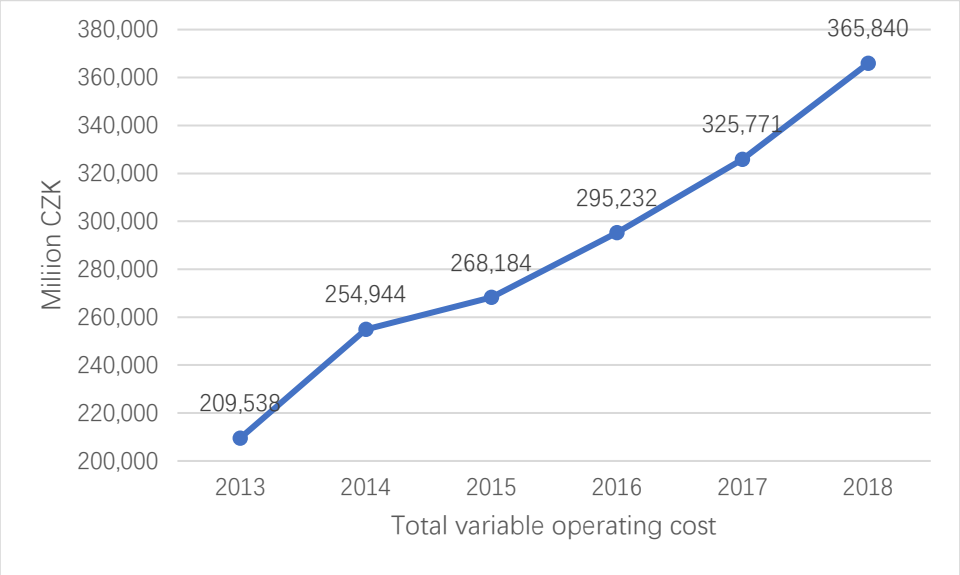
Table 4.38 Total variable operating cost from 2013 to 2018

	Total variable operating cost
2013	**209,538**
2014	**254,944**
2015	**268,184**
2016	**295,232**
2017	**325,771**
2018	**365,840**

(Unit of currency is in million CZK)

Then we reflect the results in chart.

Chart 4.31 Total variable operating cost from 2013 to 2018



From chart 4.31, we can know that the total variable operating cost is increasing from 2013 to 2016 and is also from 2017 to 2018. One reason is that the average operating cost for produce 1 car is increasing and the other is the increasing of the quantity year by each.

4.3.2 Prediction of fix operating cost

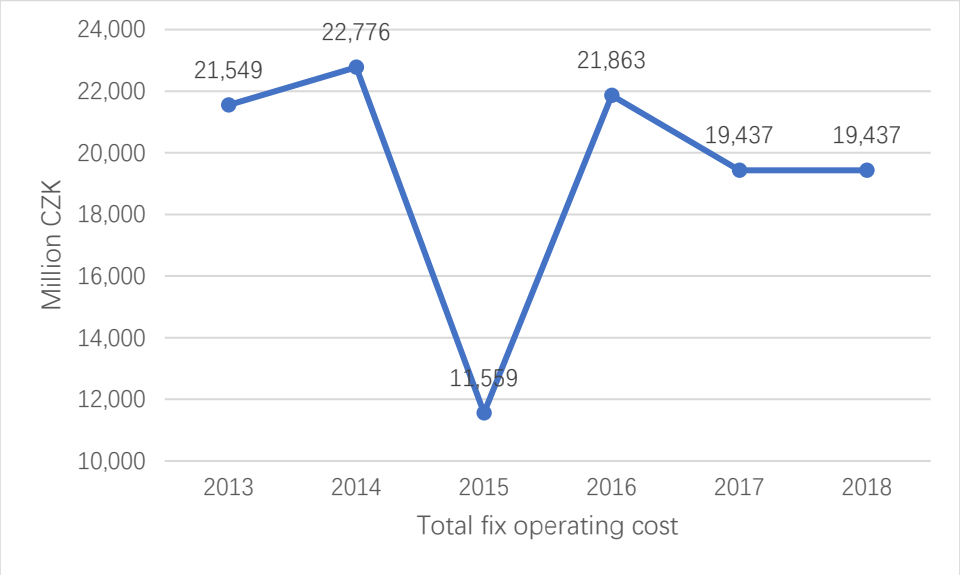
After calculating the total variable operating cost of our company in 2018, we start to calculate company's fix operating cost in 2018. We use the estimation method of arithmetic mean and the results is as followed.

Table 4.39 Total fix operating cost in from 2013 to 2018

	2013	2014	2015	2016	2017	2018
Distribution expenses	**13,067**	**13,466**	**13,272**	**13,503**		
Administrative expenses	**6,679**	**6,939**	**7,273**	**7,843**		
Other operating income	**6,024**	**5,130**	**18,779**	**6,498**		
Other operating expenses	**7,827**	**7,501**	**9,793**	**7,015**		
Total fix operating cost	**21,549**	**22,776**	**11,559**	**21,863**	**19,437**	**19,437**

From table 4.39, we can know the total fix operating cost from 2013 to 2016 and we use the average value as the total fix operating cost in 2017 and 2018. Then we can observe it by chart.

Chart 4.32 Total fix operating cost in from 2013 to 2018



From Chart 4.32, we can clearly see that the total fix operating cost is increased from 2013 to 2014 from 21,549 million CZK to 22,776 million CZK and decreases to 11,559 million CZK in 2015. The reason for the decreasing is that other operating income is 18,779 million CZK which is 5,130 million CZK in 2014. Then it is increased from 2015 to 2016 to 21,863 million CZK. For the total fix operating cost in the year 2017 and 2018, it is the average value of total fix operating cost from 2013 to 2016

4.3.3 Calculation the results

In chapter 4.3.1 and chapter 4.3.2, we estimate the total variable operating cost and total fix operating cost in the 2017 and 2018. Then, we can use the function 4.2 to calculate the total operating cost.

Table 4.40 Prediction of total operating cost in 2017 and 2018

	2017	2018
Total variable cost	**325,771**	**365,840**
Total fixed cost	**19,437**	**19,437**
Total cost of production	**345,208**	**385,276**

(Unit of currency is in million CZK)

The table 4.40 reflects the results of prediction of total operating cost in 2017 and 2018. In order to see the trends from 2013 to 2018, we should summarize total operating cost from each year and it is as followed.

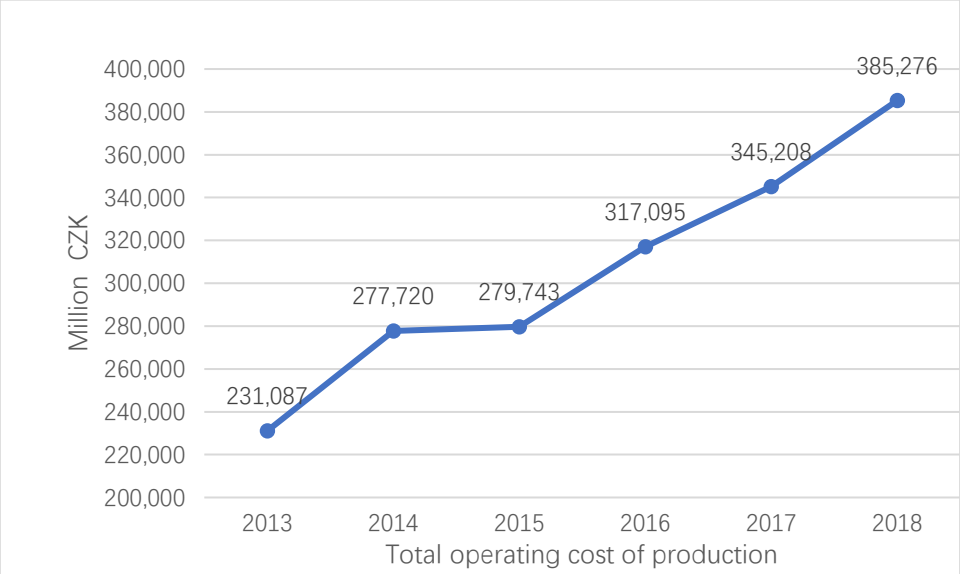
Table 4.41 Summarize of the total operating cost from 2013 to 2018

	Total operating cost
2013	**231,087**
2014	**277,720**
2015	**279,743**
2016	**317,095**
2017	**345,208**
2018	**385,276**

(Unit of currency is in million CZK)

From table 4.41, we can see the total operating cost of production of our company from 2013 to 2018 and then we can observe its trend by chart followed.

Chart 4.33 Total operating cost from 2013 to 2018



From chart 4.33, we can see the total operating cost is increasing from 231,087 million CZK to 385,276 million CZK from 2013 to 2018.

4.4 Estimation of company's net operating income

From the chapter 4.2 and 4.3, we have predicted company's consolidated operating revenues and total operating costs, so we can calculate company's consolidated net operating income.

Table 4.42 Consolidated operating income in 2018

	Total operating revenues	**Total operating costs**	**Net operating income**
S1	**426,936**	**385,276**	**35,410**
S2	**428,918**	**385,276**	**37,096**
S3	**445,901**	**385,276**	**51,531**
S4	**424,744**	**385,276**	**33,548**
S5	**412,667**	**385,276**	**23,282**
S6	**429,577**	**385,276**	**37,655**
S7	**418,710**	**385,276**	**28,418**
S8	**424,729**	**385,276**	**33,535**
S9	**439,770**	**385,276**	**46,320**
S10	**405,394**	**385,276**	**17,100**

(Units of currency is in million CZK)

Table 4.42 reflects results of first 10 scenarios from 1000 scenarios estimation and then we need to do the frequency analysis for the 1000 scenarios of estimations.

Table 4.43 Preparation for frequency analysis of net operating income

MIN	MAX	Equidistant interval	Numbers of steps
2,965	69,392	3,496	20

From table 4.43, we can know that the min interval is 2,965 in 1000 scenarios of and the results, max interval is 69,392 and the equidistant interval value is 3,496.

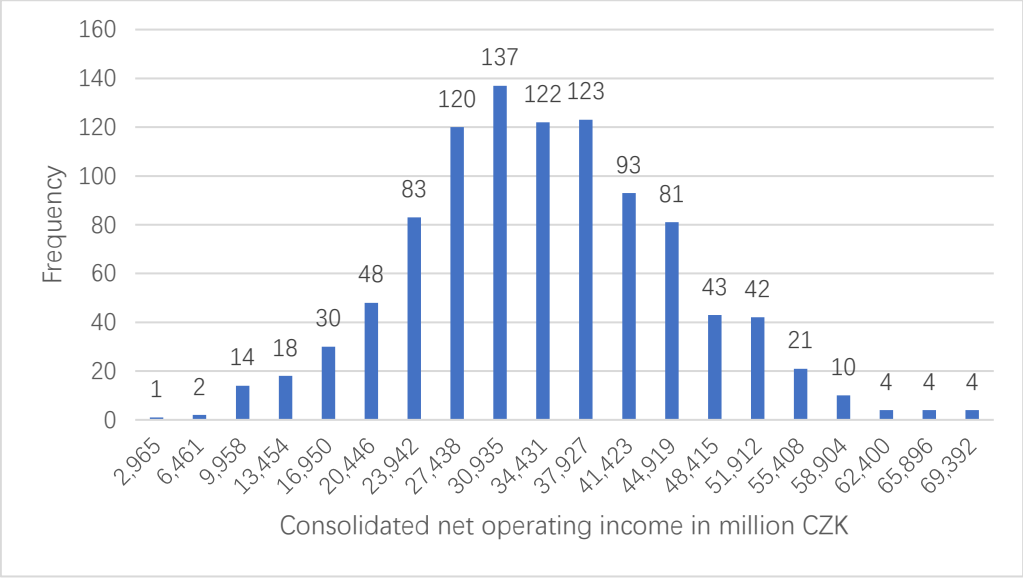
Table 4.44 Frequency analysis of net operation income in 2018

	Net operating income in million CZK	Frequency	probability
I1	**2,965**	1	0.1%
I2	**6,461**	2	0.2%
I3	**9,958**	14	1.4%
I4	**13,454**	18	1.8%
I5	**16,950**	30	3.0%
I6	**20,446**	48	4.8%
I7	**23,942**	83	8.3%
I8	**27,438**	120	12.0%
I9	**30,935**	137	13.7%
I10	**34,431**	122	12.2%
I11	**37,927**	123	12.3%
I12	**41,423**	93	9.3%
I13	**44,919**	81	8.1%
I14	**48,415**	43	4.3%
I15	**51,912**	42	4.2%
I16	**55,408**	21	2.1%
I17	**58,904**	10	1.0%
I18	**62,400**	4	0.4%
I19	**65,896**	4	0.4%
I20	**69,392**	4	0.4%
Sum		1000	100%

(Units of currency is in million CZK)

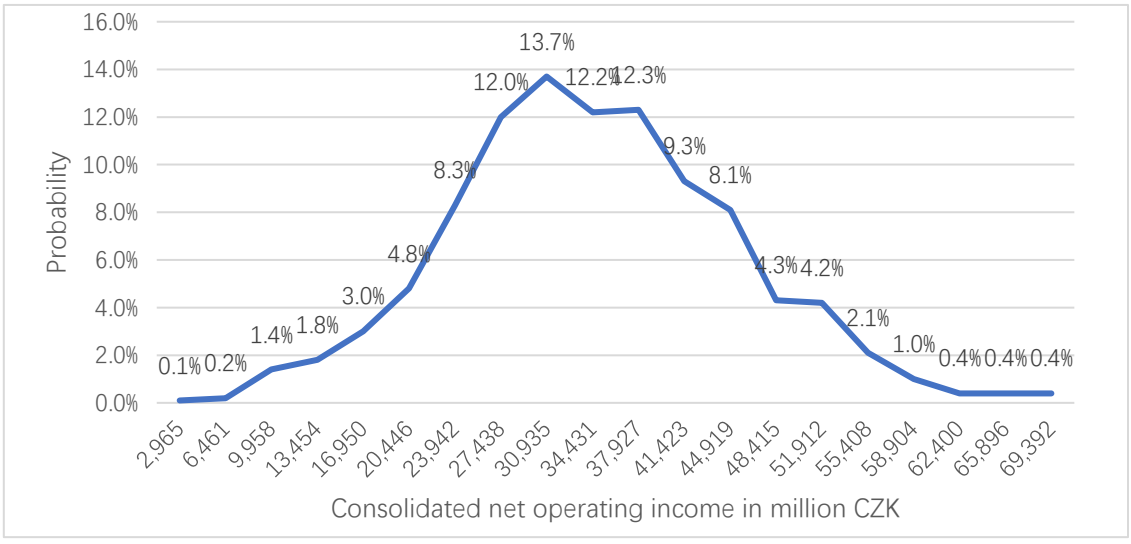
In the table 4.44, we can see the results of frequency analysis and we make it to the chart.

Chart 4.34 Frequency of net operating income in 2018



From chart 4.34, we can know that, the highest frequency of net operating income is in the interval 27,438 CZK to 30,935 million CZK.

Chart 4.35 Probability of revenues from China transfer to CZK



From chart 4.35, we can know the probability distribution of company net operating income from 1000 scenarios. The net operating income between 27,438 CZK to 30,935 million CZK has the highest probability which is 13.7%.

Table 4.45 Key parameters of frequency analysis

Mean	Stand deviation
32,808	**10,800**

Then, we give several confidence levels of 97.5%, 95%m 92.5% and 90%. The results are as followed.

Table 4.46 Net operating income under different confidence level

Confidence level	90%	92.50%	95%	97.50%
	19,674	**17,378**	**15,437**	**12,198**

(Units of currency is in million CZK)

From table 4.45, we can know that the net operating income has 90% probability to be more than 19,674 million CZK, 92.5% probability to be more than 17,378 million CZK, 95% probability to be more than 15,437 million CZK and 97.5% probability to be more than 12,198 million CZK.

5. Conclusion

ŠKODA AUTO, a.s. Company is a famous automobile manufacturer in the world. When the company sell their cars around the world, it must face the market risk from different floated exchange rates. Our aim of thesis is to estimate company's net operating income probability distribution in 2018 with CorporateMetrics methodology.

In chapter 3, we introduce basic history of our company at first. Then we analysis the financial condition of our company and get conclusion that our company has a stable growth rate for total assets, but the net operating income start to decrease after 2015, which is influenced by the appreciation of the CZK. At last, we do the SWOT analysis and the conclusion is followed. Our company has the strength on services, car styles and the relationship of customer. The weakness is mainly on the distribution channel. The opportunities include corporation with other companies and the transaction of customers. For the treats company faced is mainly the competition and the innovation speed.

In chapter 4, we start to apply our methodology to do the prediction. We predict the parameters we need steps by steps and then estimate the net operating income. We get the conclusion that, there are 97.5% probability that our company's net operating income will be more than 12,198 million CZK in 2018.

Bibliography

[1] BENNINGA SIMON. Financial Modeling (MIT Press). 4th ed. Cambridge, Mass: The MIT Press, 2014. ISBN 978-0262027281.

[2] BODMER, Edward. Corporate and Project Finance Modeling. 1st ed. New York: Wiley, 2014. ISBN 9781-118-85436-5.

[3] LEE, Alvin Y. CorporateMetrics Technical Document [online]. New York: RiskMetrics Group, J. P. Morgan, 1999. [2017-08-04]. Available at: https://www.msci.com/documents/10199/8af520af-3e63-44b28aab-fd55a989e312.

[4] PIGNATARO PAUL. Financial Modeling and Valuation: A Practical Guide to Investment Banking and Private Equity. 1st ed. New York: Wiley, 2013. ISBN-13: 978-1118558768.

[5] SOUBEIGA ERIC. Mastering Financial Modeling: A Professional's Guide to Building Financial Models in Excel. 1st ed. New York, McGraw-Hill. ISBN: 978-0071808507

[6] GEORGE CAMPBELL. Measures and Metrics in Corporate Security. 2nd ed. New York: Elsevier, 2014. ISBN 978-0128006887.

[7] ZMEŠKAL, Z., D. DLUHOŠOVÁ and T. TICHÝ. Financial Models. 1st ed. Ostrava: VSB-Technical University of Ostrava, 2004. ISBN 80-24807548.

Electronic Bibliography

[8] The annual report of ŠKODA AUTO, a.s. Company (2013 to 2016) [Online]. [15.4 2018] Available at http://www.skoda-auto.com/company/about

[9] Exchange rate of CNY to CZK [Online]. [15.4 2018] Available at https://www.exchanger-ates.org.uk/CNY-CZK-exchange-rate-history.html

[10] Exchange rate of EUR to CZK [Online]. [15.4 2018] Available at https://www.exchanger-ates.org.uk/EUR-CZK-exchange-rate-history.html

[11] Exchange rate of GBP to CZK [Online]. [15.4 2018] Available at https://www.exchanger-ates.org.uk/GBP-CZK-exchange-rate-history.html

[12] Wikipedia [online]. [15.4.2018]. Available on http://en.wikipedia.org/

List of Abbreviations

R	Revenue
Q	Quantity of car being produced
μ	Average logarithmic price change
σ	Standard deviation of logarithmic price change
S_t	Market price in time t
α	Trend coefficient of the history data;
$\tilde{z}$	Random variable we
USD	United States Dollars
GBP	Great Britain Pounds
RMB	Chinese Yuan

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Ostrava dated 15.04.2018

Zhongming YU

Student's name and surname

List of Annexes

Annex 1 Income Statement

Million CZK	2013	2014	2015	2016
Sales	243,624	299,318	314,897	347,987
Cost of sales	209,538	254,944	268,184	295,232
Gross profit	34,086	44,374	46,713	52,755
Distribution expenses	13,067	13,466	13,272	13,503
Administrative expenses	6,679	6,939	7,273	7,843
Other operating income	6,024	5,130	18,779	6,498
Other operating expenses	7,827	7,501	9,793	7,015
Operating profit	12,537	21,598	35,154	30,892
Financial income	2,007	2,367	1,781	2,777
Financial expenses	1,594	2,616	2,697	2,820
Financial result	413	-249	-916	-43
Profit before income tax	12,950	21,349	34,238	30,849
Income tax expense	1,564	2,928	3,422	5,686
Profit for the year	11,386	18,421	30,816	25,163

Annex 2 Balance sheet

In million CZK

Assets	2013	2014	2015	2016
Intangible assets	21,488	25,168	24,813	21,483
Property, plant and equipment	61,446	65,916	65,642	64,509
Investments in subsidiaries	247	49	49	49
Investments in associates	2,352	2,352	2,352	2,352
Other non-current receivables and financial assets	866	9,047	11,185	13,575
Deferred tax asset	1,524	2,607	3,613	2,870
Non-current assets	87,923	105,139	107,654	104,838
Inventories	11,092	12,326	15,115	16,093
Trade receivables	11,290	11,941	11,937	16,830
Other current receivables and financial assets	9,727	4,387	5,629	17,163
Prepaid income tax	43	0	0	0
Cash and cash equivalents	31,926	42,878	62,280	73,256
Assets classified as held for sale	0	198	0	0
Current assets	64,078	71,730	94,961	123,342
Total assets	152,001	176,869	202,615	228,180
Equity and liabilities				
Share capital	16,709	16,709	16,709	16,709
Share premium	1,578	1,578	1,578	1,578
Retained earnings	74,162	86,890	103,963	113,726
Other reserves	-2,133	-5,176	-4,768	5,567
Equity	90,316	100,001	117,482	137,580
Financial and other non-current liabilities	4,820	7,898	5,744	4,164
Non-current provisions	7,774	10,509	13,197	14,270
Non-current liabilities	12,594	18,407	18,941	18,434
Current financial liabilities	3,106	0	0	0
Trade liabilities	29,314	35,741	38,012	41,903
Financial and other current liabilities	6,183	10,280	10,966	8,278
Current income tax liabilities	0	1,559	2,375	3,294
Current provisions	10,488	10,881	14,839	18,691
Current liabilities	49,091	58,461	66,192	72,166
Total liability	61,685	76,868	85,133	90,600
Total equity and liabilities	152,001	176,869	202,615	228,180